707-8

POND CONTINUOUS SASH
POND OPERATING DEVICE
POND TRUSS ROOF DESIGN

Lupton
INVESTMENT VALUE

truss roof sash

Catalogue 10-PCS, 1st ed.
(Superseding corresponding chapters of No. 9 Catalogue)

DAVID LUPTON'S SONS COMPANY
Agate Street and Allegheny Avenue
PHILADELPHIA, PA.

CHICAGO
NEW YORK

PITTSBURGH
CLEVELAND

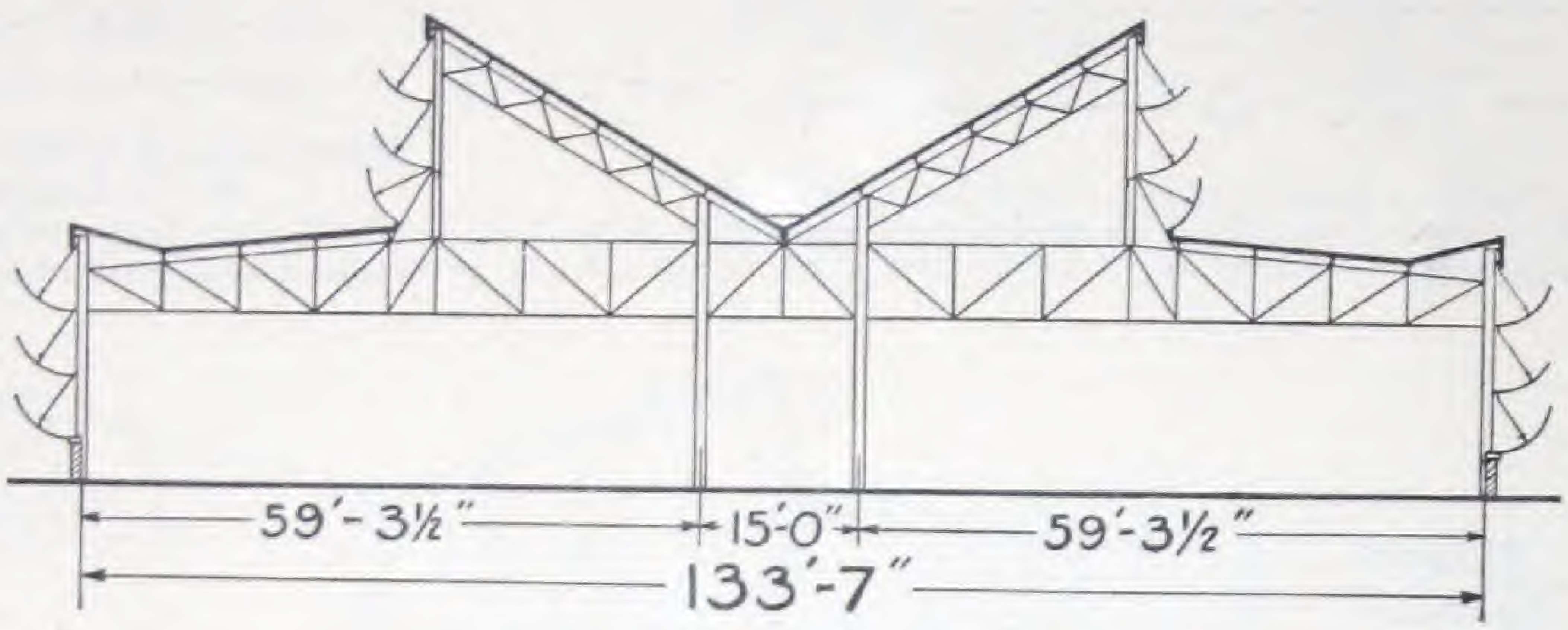
BOSTON
DETROIT

TYPICAL POND TRUSS CROSS SECTIONS

The adaptability of the Pond Truss roof to different requirements is shown by the views below and on the inside front and back covers.

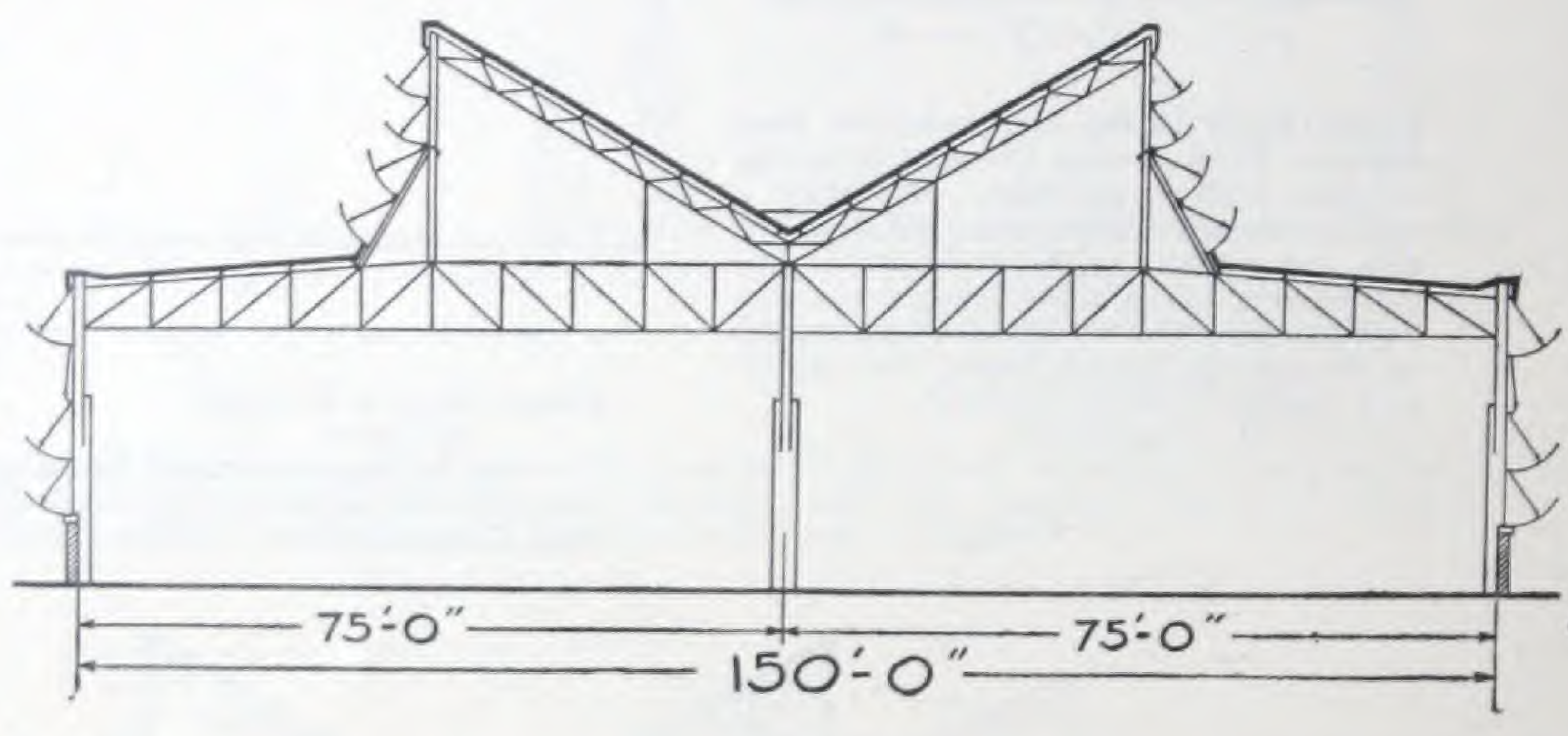
For comparison all views follow a uniform scale of 33 ft. to 1 inch, except the floor plan of the Bunting Brass & Bronze Co. foundry, which is reduced.

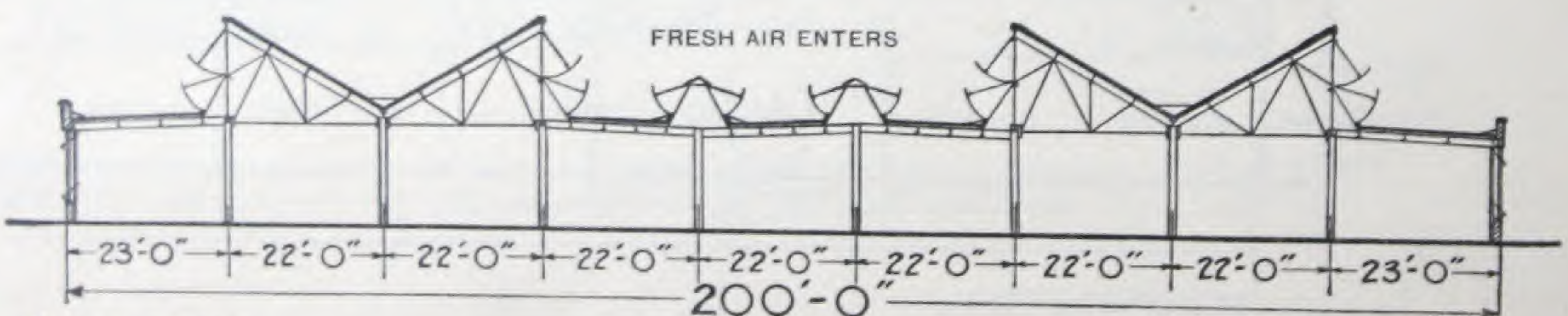
Special attention is invited to the detail of a typical Fresh Air Bay on the next cover page, and to the text regarding it on page 33.



Cleveland Co-operative Stove Co., Foundry, Cleveland, Ohio.
Geo. S. Rider & Co., Engineers.
See interior view, page 17.
Height to bottom chord of truss 16 feet. This foundry produces a high grade of small and accurate gray iron castings, not only for stoves, but for fine machine parts. The daylighting is so ample that artificial lights are practically never used.

Typical design for a foundry 150 ft. wide. Pond Continuous Sash is used in the lower side walls in order to secure uniform distribution of fresh air without dependence on individual workers.





Mr. Conrad F. Neff
Architect

National Pneumatic Co.
Machine Shop, Rahway, N. J.

An excellent design in structural steel for a light machine shop. Height to bottom chords of trusses 15 feet. See views on page 17. Fresh air enters by the side walls and Pond A-frames. Mass operation of the Pond Continuous Sash facilitates uniform air movement over the entire area.

LUPTON SERVICE

The application of Pond Continuous Sash and other Lupton Sash Products to the buildings shown in these pages has been a gradual growth.

First applied in sawtooth roofs, Pond Continuous Sash quickly proved its value for many other uses. By effectively combining weather protection with mass control over large areas, it has given rise virtually to a new science of natural ventilation. Instead of admitting and discharging air at a few scattered points, Pond Continuous Sash makes possible a uniform air movement—slow or rapid as desired—throughout an entire building. Instead of the floor width being restricted as formerly to what could be ventilated by haphazard opening of individual sash, it is now feasible to design solely for efficient layout and adequate daylighting. Any building that can be daylighted can be ventilated abundantly by Pond Continuous Sash. A one-story building, indeed, may be of practically any width without sacrifice of fresh air, by using a properly-planned Pond Truss roof.

In working with our customers' architects and engineers to develop these unusual applications of our products, we have learned many interesting things not found in conventional practice. Better distribution of daylight is one: it is as easy sometimes to get too much light as too little; and in a one-story building neither the sawtooth nor ordinary monitor roofs diffuse the light as well as the forms here shown.

The most valuable discoveries, however, relate to natural air movements under average conditions. These air movements are much more subtle and hard to define than the lighting. Light moves in straight lines, and the laws of reflection, refraction and diffusion are well understood. But natural air movements depend on very slight differences in pressure, which in turn may be due to temperature, wind, size and location of openings, shape of roof, height and location of surrounding buildings, and a score of other influences hard to estimate. Yet it is far simpler and more economical to utilize natural air movements, when they can be created by correct design of the building, than it is to discard them in favor of costly systems of forced ventilation.

It has been our privilege to contribute to the design of some hundreds of buildings of all kinds in which the ventilation demanded special study. With this experience we are able to offer a unique degree of co-operation with architects and engineers, to the end that their clients may realize the full lighting and ventilating possibilities of our products. We maintain a large Engineering Department for this purpose, and are always glad to offer suggestions on preliminary sketches. In this way we are often able to add much to the usefulness of the proposed buildings, sometimes at little or no added cost.

We regard this service as part of the obligation we owe our customers, and make no specific charge for it. Aside from the superior quality of Lupton Sash Products themselves, it is one of the things that make "Lupton" stand for "Investment Value"—not merely of the sash, but of the entire building considered as a tool for production.

We have published special booklets on the application of Pond Continuous Sash and other Lupton Products to heat-producing buildings, power houses, machine shops and general manufacturing buildings. Copies will be sent on receipt of request, stating in which types of buildings you are interested.

POND CONTINUOUS SASH

(Patented by Clarke P. Pond, and Patents Pending)

The very wide, crowded factories now becoming common, and buildings in which heat or fumes are produced, create a special ventilating problem which cannot be satisfactorily solved by individually-opened types of sash. Windows are left shut that should be open; fresh air enters in streaks, here and there, alternating with masses of vitiated air that has no means of escape; and both outflow and inflow are governed largely by chance. The result is seen in sluggish thinking and sluggish movement of the workers, in needless sickness, and in accidents which alertness would prevent.

Pond Continuous Sash overcomes this condition by giving uniformly-distributed inflow and outflow, dependent neither on the weather nor on the whims of the workers. Correctly used, in buildings correctly designed, it enables ventilating results to be accomplished which are impracticable with other forms of sash. These results amount in certain cases to a virtual revolution, both in building design and in the quality or quantity of product that may be produced in a given floor space.

Pond Continuous Sash is most frequently used in the roofs of heat-producing buildings, such as foundries, forge shops, rolling mills and blast furnace plants, power houses, core shops, glass factories and sugar refineries. In all these its scientific use has resulted in new standards of physical comfort and operating economy.

In addition, it is used to secure uniformly-distributed inflow in the side walls of the same class of buildings. It is also used to great advantage, both in the roofs of wide buildings for general manufacturing, and in side walls of multi-story buildings where combined ventilation and weather protection are especially desired. It is equally suited for outlets and inlets, in both roofs and side walls.

Pond Continuous Sash has two important functions; *weather protection* and *mass control*. In effect, it is a continuous transparent shed over a ventilating opening. The openings may be of almost indefinite length (the weight of the sash when open being balanced by counterweights, and electric motors being used when specified).

This mass-control feature results in taking ventilation out of the hands of individuals and placing it in command of the foreman. The average workman does not notice bad air, and will not trouble to open windows unless forced to do so by physical discomfort. Hence the majority of workers in the average factory must breathe bad air because those next to the windows do not open them. The only effective remedy is to make the sash controllable in mass at the direction of the foreman. Pond Continuous Sash accomplishes this, and at the same time renders the ventilation independent of weather.

Effective weather protection has an obvious cash value in roofs and monitors, since it makes it unnecessary to close the sash for sudden showers; it is often useful also in side walls, as it permits placing benches, etc., close to the windows without danger of rain spoiling goods or equipment.

To get the full benefit from a form of sash so different from conventional types, the building must be designed for it. In the case of heat-producing buildings this may mean a radical departure from conventional designs. The mass control of Pond Continuous Sash implies not only abundant but uniform movement of air. The basic principle of its

action is in fact a slow but general movement of air of equal volume throughout the entire floor or building, avoiding both stagnation and unpleasant drafts.

To carry this principle into effect requires, for one-story buildings, a roof formation that creates the natural air movements desired; together with such disposition of openings, and types and control of sash, as will give both outflow and inflow at the desired points. Not only the upward tendency of heat currents, but the possibility of down drafts resulting from unsuitable sash, must be considered; and the heat-producing processes (if any) must be so located as to utilize the air movements resulting from them.

In multi-story buildings there is less freedom of arrangement; but the very limitations on design require that the probable effect of each feature be carefully studied. By discarding precedent, and designing to utilize fully the qualities of the sash, some strikingly effective results may be obtained.

In the chapter on the Pond Truss (page 31) is described the type of roof which we have found most generally satisfactory for use with Pond Continuous Sash. It is adapted, not only to the heat-producing buildings for which it was first designed, but to almost all one-story buildings and wide top floors where the best light distribution, or unusual ventilation, or both, is desired. Some examples of this roof are shown here; others in the Pond Truss chapter.

For sawtooth roofs the complete weather protection afforded by Pond Continuous Sash is very desirable, as these roofs are generally used over costly products and equipment. On account of its ventilating limitations the sawtooth should never be used on foundries or forge shops, and is not generally desirable for buildings of more than moderate width; but by specially controlling the sash to secure uniform air movement good results may be had in manufacturing buildings of not too great width, where haphazard control would fail.

A striking example of this special control is found in the B. F. Goodrich Building No. 40, illustrated on page 29. Each wing is 100 feet wide, and a thousand workers assemble rubber footwear on the top floor. Uniform escape of stale air is secured by connecting all the operated lines of sawtooth sash in each wing and operating them by one electric motor. Uniform inflow is secured by hanging lengths of Pond Continuous Sash between pilasters above the sliding windows, and operating them in long runs.

Pond Continuous Sash is used also in monitors of all types, and in Pond A-frames. For these it should be used in continuous runs outside of structural work. In side walls it is preferably used in the same manner, but it may be applied in short lengths between pilasters, being operated in lines or groups as desired. Under any condition the slope when closed should not be greater than 30 degrees from the vertical. In sawtooths two lines of sash should be used; the upper line is 3 or 4 feet high and is always operated; the lower line may be from 3 to 6 feet high, stationary or operated as desired.

A special application is the Pond A-frame. It consists of a series of A-shaped frames, hung with one or more lines of Pond Continuous Sash each side. One or more lines each side may be operated.

The Pond A-frame has three principal uses:

First and chief is as an inlet for light and fresh air between parallel Pond Trusses, in wide buildings. The Pond Trusses act as outlets; and buildings so designed may

be of indefinite width, with their central area lighted and ventilated by the alternating Pond Trusses and Pond A-frames. They may be foundries, forge shops and the like, or manufacturing buildings.

Second is in the roofs of light courts. For these, Pond A-frames are far more satisfactory than skylights, sawtooths or monitors, since they reduce the harsh direct sunlight admitted by skylights, while rendering nearly the entire roof area available for both light and ventilation.

Third is in the roofs of ordinary buildings where conditions do not require a Pond Truss, monitor or sawtooth. For this purpose they have the advantage of giving abundant air and ample (though not always uniform) light.

General Construction

Pond Continuous Sash consists of a series of units, hinged at the top and connected into a continuous line which is hung outside of all structural work. The end sections of the units overlap to form flexible expansion joints. Construction at head, expansion joints and ends affords full weather protection, so that the line forms an unbroken transparent shed over the ventilating opening.

At the head the sash is protected by an overhanging continuous angle girt, which forms part of the general structure and is supported throughout by structural members to insure proper alignment. The ends overlap storm panels, each consisting of a light of glass 2 feet wide in a steel frame, which excludes diagonal rains.

A new feature is the construction of the expansion joints, which is shown on page 7. No loose pieces are used; the joints are weatherproof above and below the overlap, as well as at the overlap itself; and the air leakage due to loose pieces is reduced one-half.

Pond Continuous Sash is operated by Pond Operating Device (see pages 23 to 30). This device, using the tension principle of transmission, operates long lines of top-hung sash with minimum friction, and gives service indefinitely without repairs.

In power houses Pond Continuous Sash is frequently divided into lengths to fit window openings, and operated in groups by Pond Operating Device. This makes a less costly window than Lupton Power House Sash, yet with equal durability and somewhat better weather protection. When properly designed the effect is highly attractive; see the Ford Motor Co. power house, shown on page 20.

Members

The members are shown in full size sections on page 7. All (except the formed member of the expansion joint) are one-piece rolled steel sections, much heavier than sash sections usually found, but their extra strength is more than justified by the better operation and low cost of maintenance thereby assured.

Special attention is called to the shape and substantial design of the patented sill member, Section 307. It accomplishes two things:

1. The inner wing, to which the sash rods are attached, is in the same plane as the outer wing, and both are of unusual depth. Hence there is no twisting or distortion of the sill member when the sash is lifted by the thrust of the operating device, and no resultant tendency to break the glass.

2. Drip holes in the outer wing drain water when the sash is open, thus making it unnecessary to resort to a filling of putty to protect the steel from corrosion at that point. We found years ago that putty could not be trusted for this purpose.

Pond Continuous Sash is suspended by malleable iron hinges with bronze pins. Hinges are preferable to a trough suspension, as the sash cannot become detached from its support.

Welded Assembly

The members of each sash unit are accurately formed and fitted, and are then solidly welded together, making a permanently rigid one-piece unit, each member re-enforcing the others. Such welding is necessarily costly, but it is far stronger and stiffer than any form of riveting or spot welding, and the elimination of joints eliminates internal corrosion.

Storm Panels

These are frames two feet wide and the height of the sash, made of 14 gauge steel plate integrally welded at the corners, and each containing a light of glass. They are placed to underlap the ends of the sash lines, thereby excluding rain in a slanting wind. Illustrations on page 7 show these panels, which are a special feature of Pond Continuous Sash. The details are such that in case a line of Pond Continuous Sash is first installed as stationary, storm panels may readily be inserted in case the line is changed to operated. (See detail, page 10, regarding this, and note that the stationary sash must be hung from an overhead angle girt in order to permit later change from stationary to operated.)

Expansion Joints

These permit expansion and contraction, also accommodate slight defects in alignment of structural work.

One member is the angle-section end rail of the sash unit. The other (overlapping) member is a formed steel plate which constitutes the end rail of the other sash unit and is solidly welded to the head and sill members.

The formed member makes a close weatherproof contact with the other sash unit at top and bottom corners, and with the sill itself, as well as along the vertical joint. Being integral with one sash member, it eliminates the leakage and loss of heat due to a loose fit at that point.

Standard Widths

Standard Sash units measure 20 feet centre to centre of expansion caps. Where desired, short end units, measuring 10, 12, 14, 16 or 18 feet centre to centre of expansion caps, will be furnished.

End units have formed end rails which overlap the muntins of the storm panels and follow the contour of the latter. Beyond each storm panel, and connected to it, is a 2-foot stationary panel, whose width is added to that of the operated sash to get the total width of opening. Openings therefore measure 4 feet wider than the operated sash, and are an even number of feet wide—no inches. Any opening, from 14 feet up and divisible by 2, may be filled with operated sash and storm panels.

In side walls between pilasters the stationary and storm panels are omitted, special formed end rails being used to overlap the flashings. Sash units are 10, 12, 14, 16, 18 or 20 feet wide, plus overlap for flashings. Openings are the same wide (*i.e.*, even feet), plus 3 inches. See detail No. 5, page 11, for measurements to be furnished us by architect for flashings to be inserted by mason before walls are set.

Standard Heights and Glass Sizes

Standard heights and glass sizes of Pond Continuous Sash are shown in the table below.

Lights 23 and 24 inches wide are combined as needed to make the desired length of sash units. In ordering new sash only the centre length of the units need be specified.

In ordering glass for replacement, the width and height of each light must always be specified. Height of lights is as follows:

No. 3 Sash 3′ high	33″
No. 4 Sash 4′ high	45″
No. 5 Sash 5′ high	57″
No. 6 Sash 6′ high	69″

Sash less than 3 feet high are not desirable, as they do not project far enough to form an effective weather hood when open. In bad weather it is impracticable to open such sash to get full ventilating effect.

Heights of openings to receive standard sash are given in the tables on pages 8, 9 and 10. When openings exceed 6 feet in height, two or more sash lines are used.

Glazing

Sash should be glazed with ¼ inch glass; wire glass for sash in roofs, wire or plain for walls. Ribbed glass is generally used; the ribs should always be vertical, and are set on the side least exposed to dust. Glass is set from outside, bedded in special putty and held securely by glazing wedges. Putty is always struck flush with outside surface of glass—not V-puttied. Sash are given a coat of heavy paint at the factory and should be painted two color coats after erection.

Operation

The success of top-hung continuous sash for ventilation depends directly on the operating device. Since the operator must lift the sash,

only a device of correct principle and ample power can open long lines to an effective width. The Pond Operating Device, by which Pond Continuous Sash is controlled, employs tension transmission and is free from the friction losses and excessive flexure of torsion and sliding devices. It is described in the next chapter.

For long lines spirals and counterweights should be specified with the operating device to balance the weight of the sash. Where lines are very long or rapid operation is desired, we advise electric motor drive. See page 27.

For mass control of ventilation, ability to open long lines easily is as important as maximum width of opening. If numerous short lines must be separately opened they are liable to be neglected. We invite comparison of the length of line and width and ease of opening, where the Pond Operating Device is used, with those obtainable with any other operating mechanism for top-hung sash.

Structural Work Required

The illustrations on pages 8 to 12 show the structural work required for the sash and operating device. A continuous angle or Z-bar girt is required at the head, and a continuous angle or similar member below the sash. When two lines of sash, one above the other, are used in sawtooth roofs or other sloping surfaces, and both are operated, a continuous angle is required above each. If the lower sash is to be permanently stationary an angle or Z-bar is not required at the head of it; see detail, page 8; but unless a girt be used, the sash cannot later be changed to operated.

Where two or more sash are used in any vertical position, a continuous angle is required at the head of each, whether they are hinged or stationary. See detail, page 10, also diagram of girt punchings, page 12.

All angle or other girts at the head and sill of sash require flashing strips at the end joints. These should be furnished by the steel contractor. See details 1 to 4, page 11.

Vertical supporting members on centers not greater than 10 feet are required for the sash and operating device. These may be angles, channels or other sections. Pond Continuous Sash and Pond Operating Device save steel work by requiring few structural supports.

Dimensions and Clearances

Over-all and opening dimensions of Pond Continuous Sash, clearance necessary at head, and locating dimensions and clearances for Pond Operating Device, are shown on pages 8 to 11. These dimensions and clearances must be strictly maintained.

Clearances for sash and hinges must be kept free of rivets and other obstructions. All structural steel supporting sash must be straight and true to line, and must be directly attached to columns to avoid inaccuracies due to use of brick walls for support.

The standard clearances shown for Pond Operating Device provide for wall brackets, sash rods, transmission lines and powers. The clearance lines shown are sufficient when kept free of all obstructions.

All estimates are based on standard construction following the dimensions and clearances shown. Extras will be charged for any special construction due to departure therefrom.

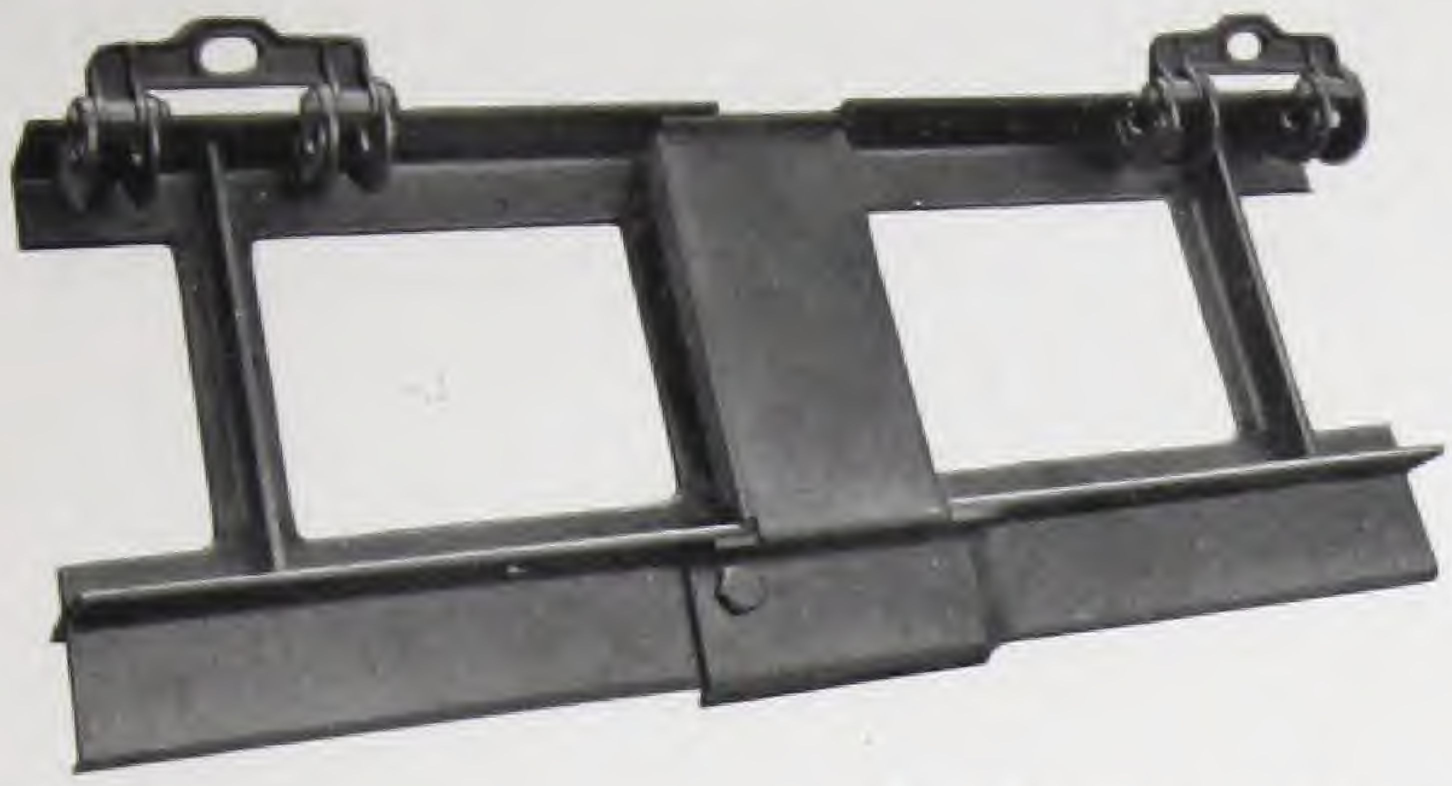
Work Not Included by Us

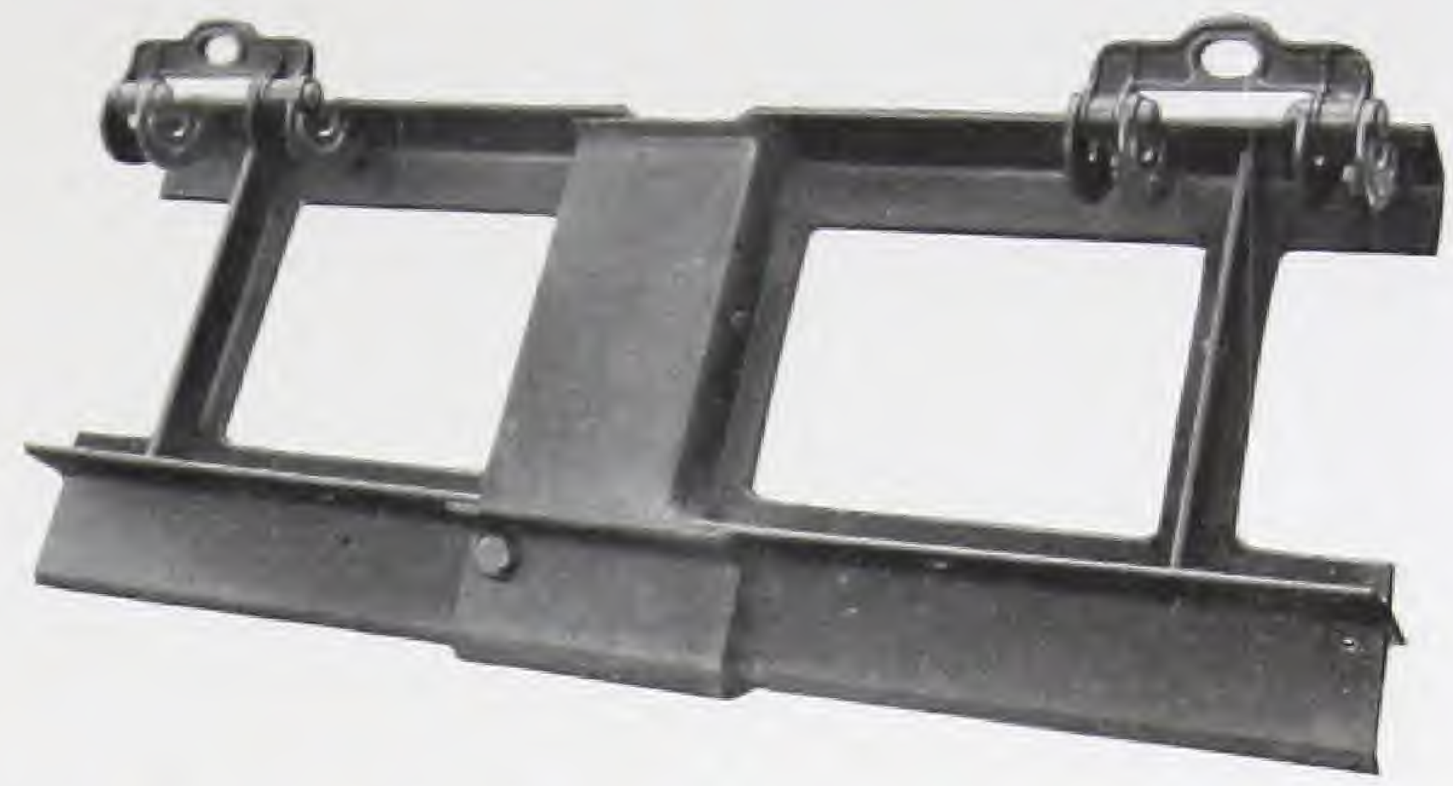
We do not furnish any of the angles, Z-bars or supporting structural work named under the head of "Structural Work Required." We do not punch the girts or structural work for the support of sash or operating device, but furnish complete drawings showing all details and punchings. We do not include with the sash any flashings at head, joints in girts, sill or ends, or any roof connections.

Specification

Specify Pond Continuous Sash made of solid one-piece rolled steel members of sizes shown on page 7; assembled by integral welding, hung on heavy malleable iron hinges with bronze pins; expansion joints formed of integrally welded members, with complete weatherproof contact, to connect sash units. Welded storm panels to be provided at the ends of all operated sash. Operation to be by Pond Operating Device, with spirals and counterweights if required. Sash made of members assembled by means other than integral welding will not be accepted.

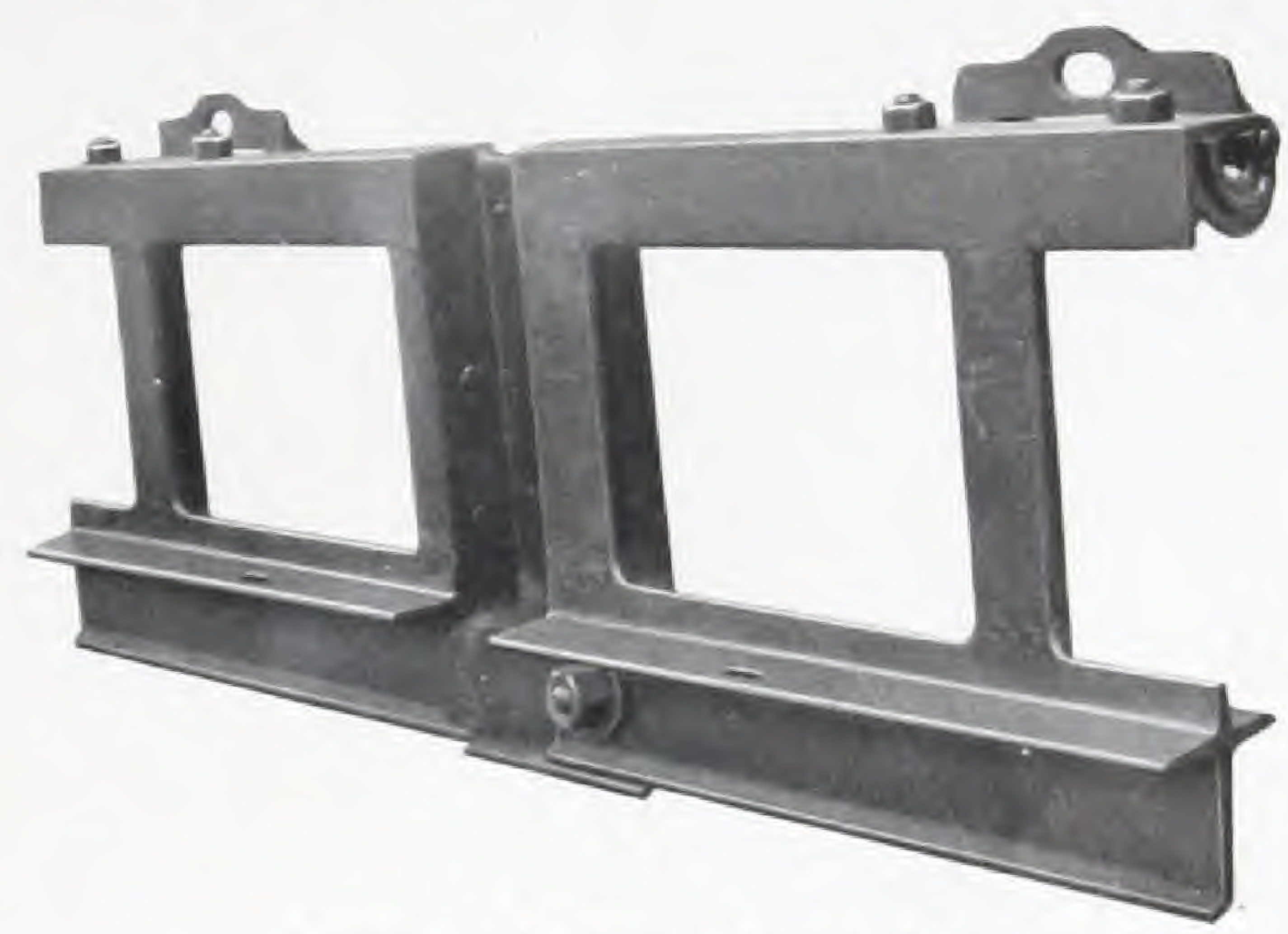
All glass to be ¼ inch thick ribbed wire glass, to be bedded in special putty and held by glazing angles.



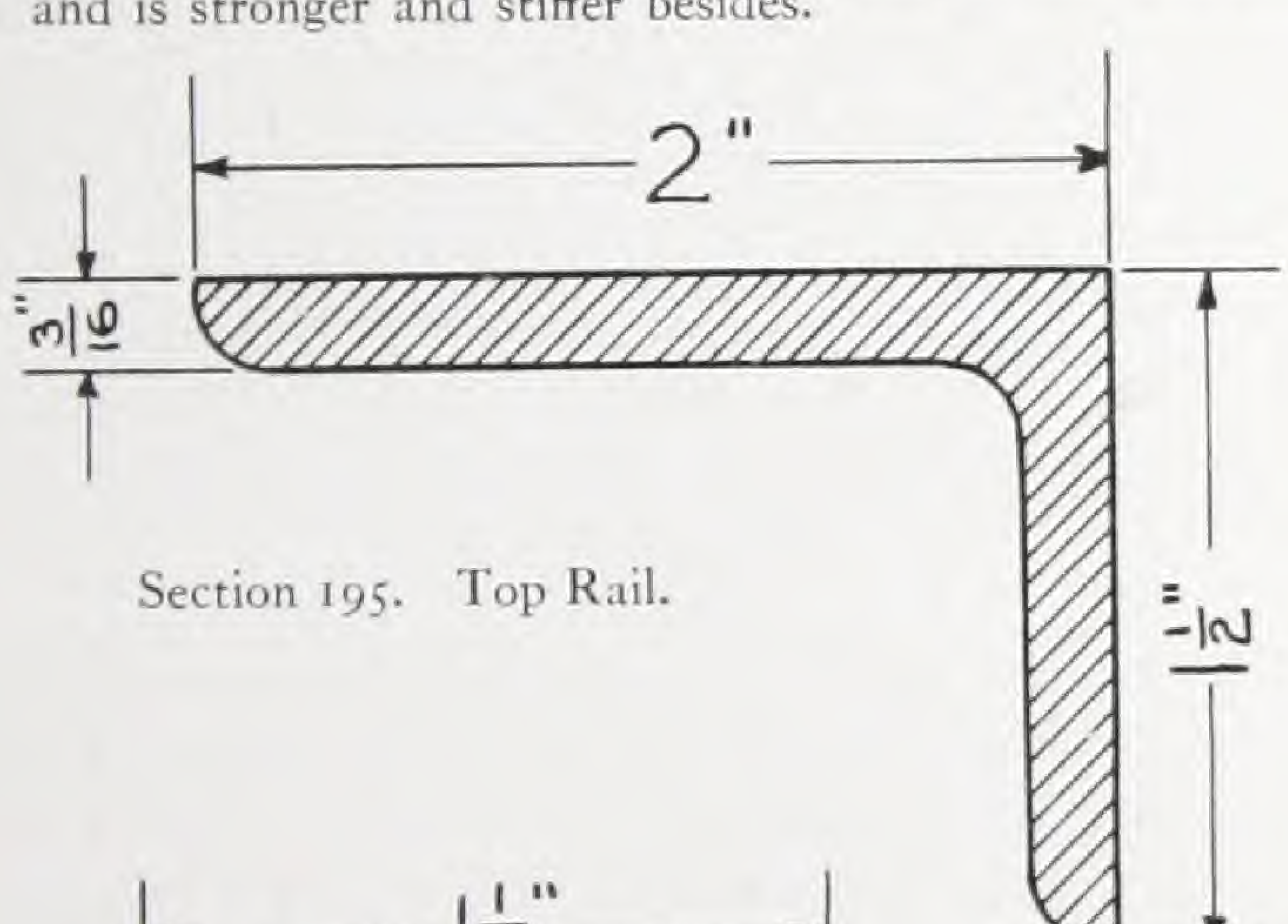


Top views show formed and welded expansion joint by which Pond Continuous Sash units are connected. A weather tight contact is made from top to bottom. The bolt at the bottom works in a slot permitting end movement.

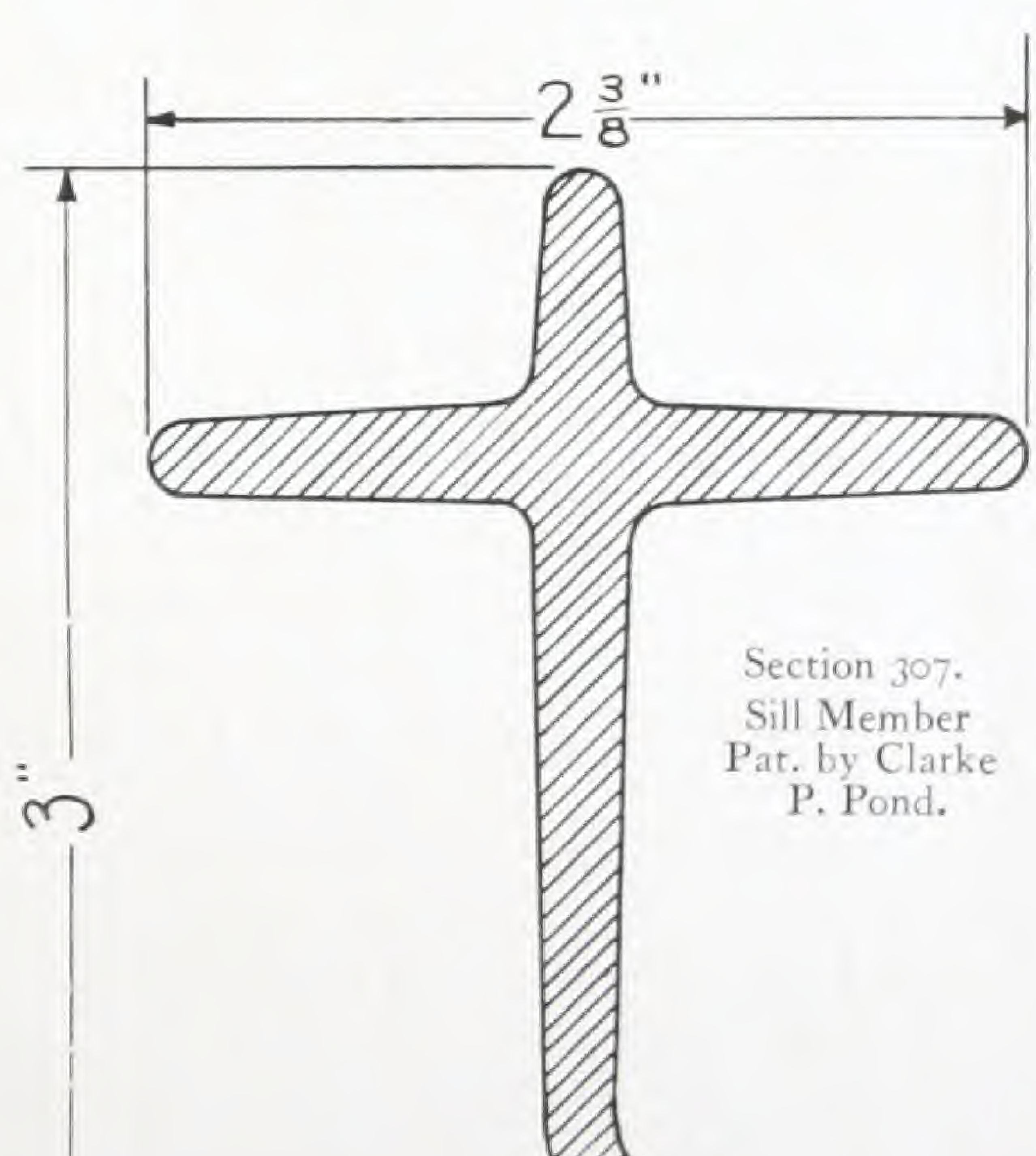
Left hand circle shows present sill member with drip holes preventing corrosion. Right hand circle shows original form of sill member and why it was discarded. To prevent water from rusting the metal when the sash was open, a dam of putty was required. This dried and broke away. The present form of sill member avoids corrosion, and is stronger and stiffer besides.



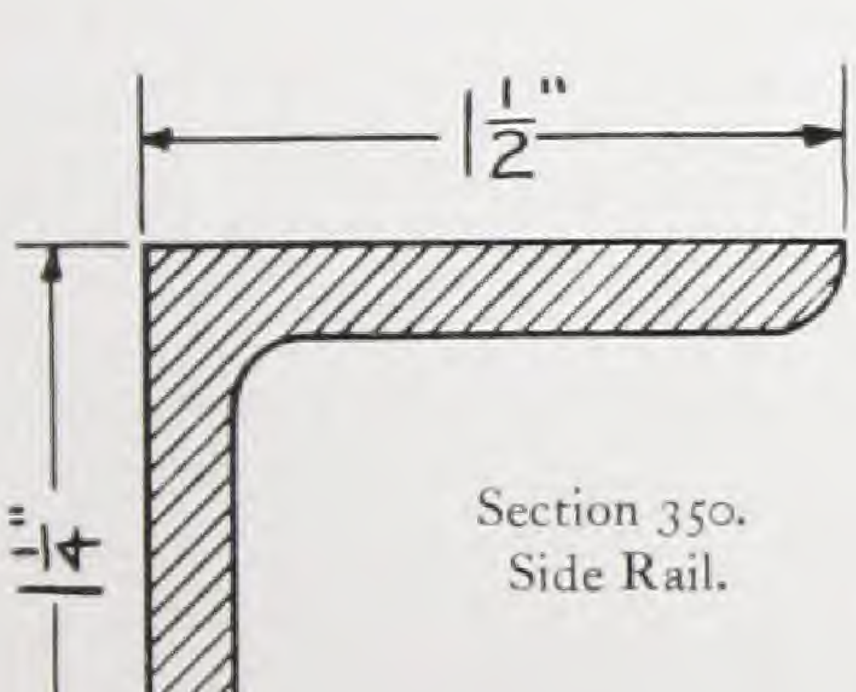
Expansion joint seen from inside.



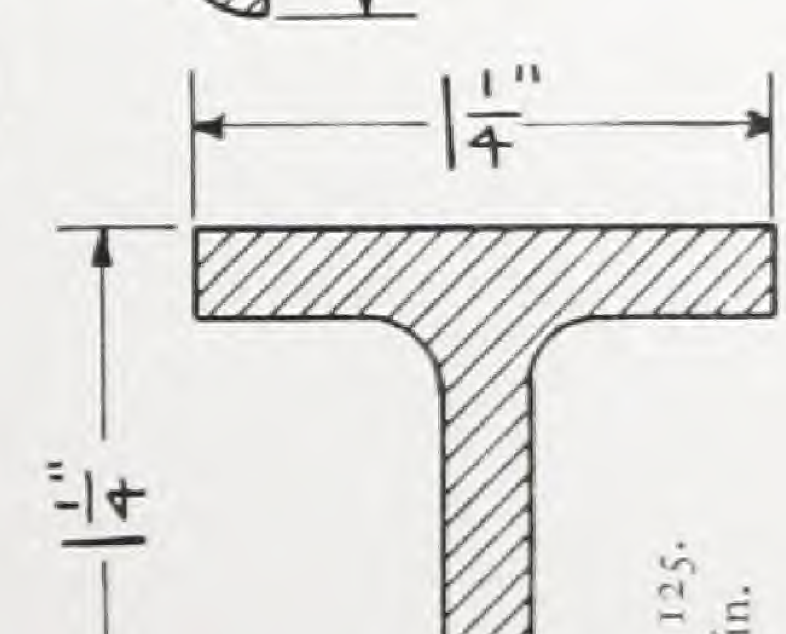
Section 195. Top Rail.



Section 307.
Sill Member
Pat. by Clarke
P. Pond.



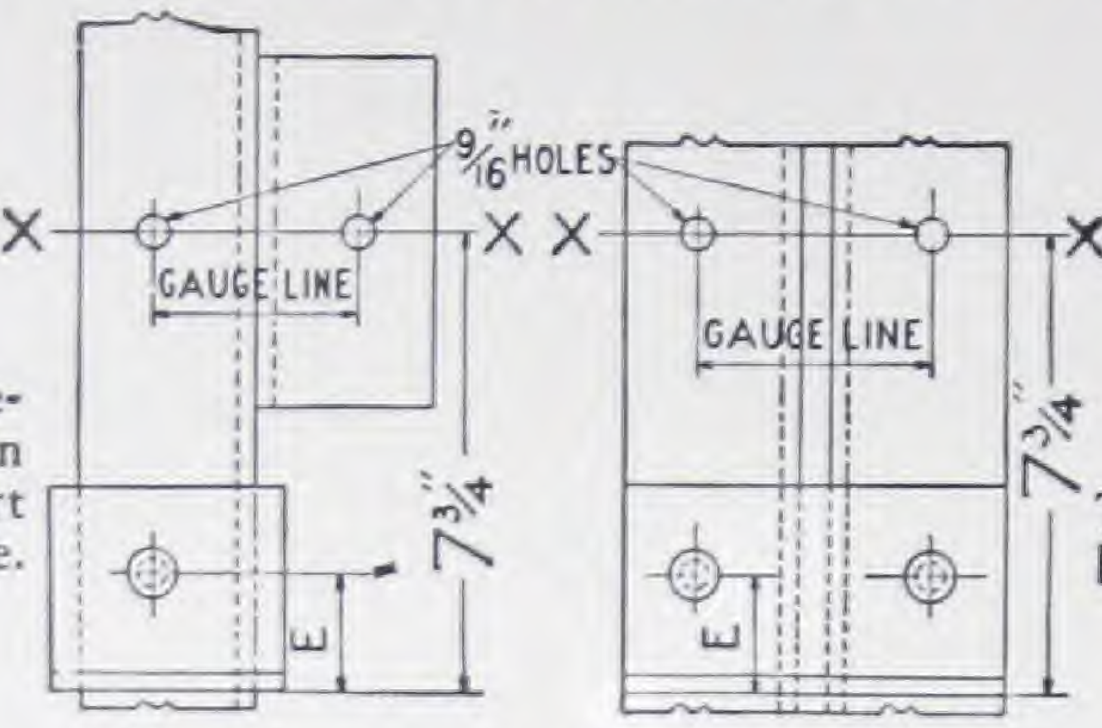
Section 350.
Side Rail.



Section 125.
Muntin.

Pond Continuous Sash Members
Sections full size

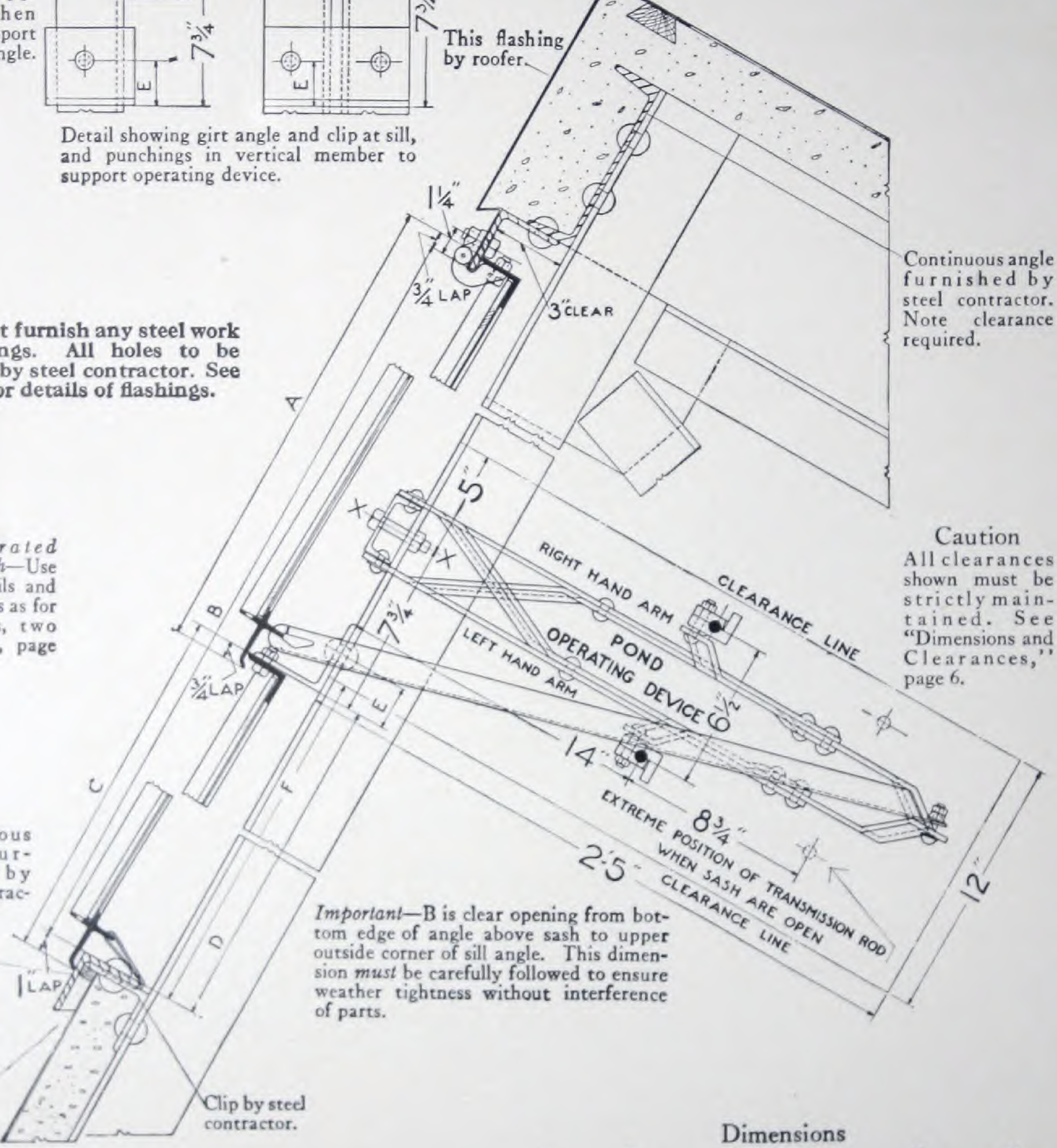
In Sawtooth Roofs and Sloping Surfaces



Bracket required when vertical support is a single angle.

Detail showing girt angle and clip at sill, and punchings in vertical member to support operating device.

Vertical Section Two Sash High



Continuous angle furnished by steel contractor. Note clearance required.

We do not furnish any steel work or flashings. All holes to be punched by steel contractor. See page 11 for details of flashings.

For operated lower sash—Use same details and dimensions as for monitors, two sash high, page 10.

Caution
All clearances shown must be strictly maintained. See "Dimensions and Clearances," page 6.

Continuous angle furnished by steel contractor.

Important—B is clear opening from bottom edge of angle above sash to upper outside corner of sill angle. This dimension *must* be carefully followed to ensure weather tightness without interference of parts.

Oakum and elastic cement by roofer.

Vertical supports shown, for sash and operating device, are required on centers not greater than 10 feet.

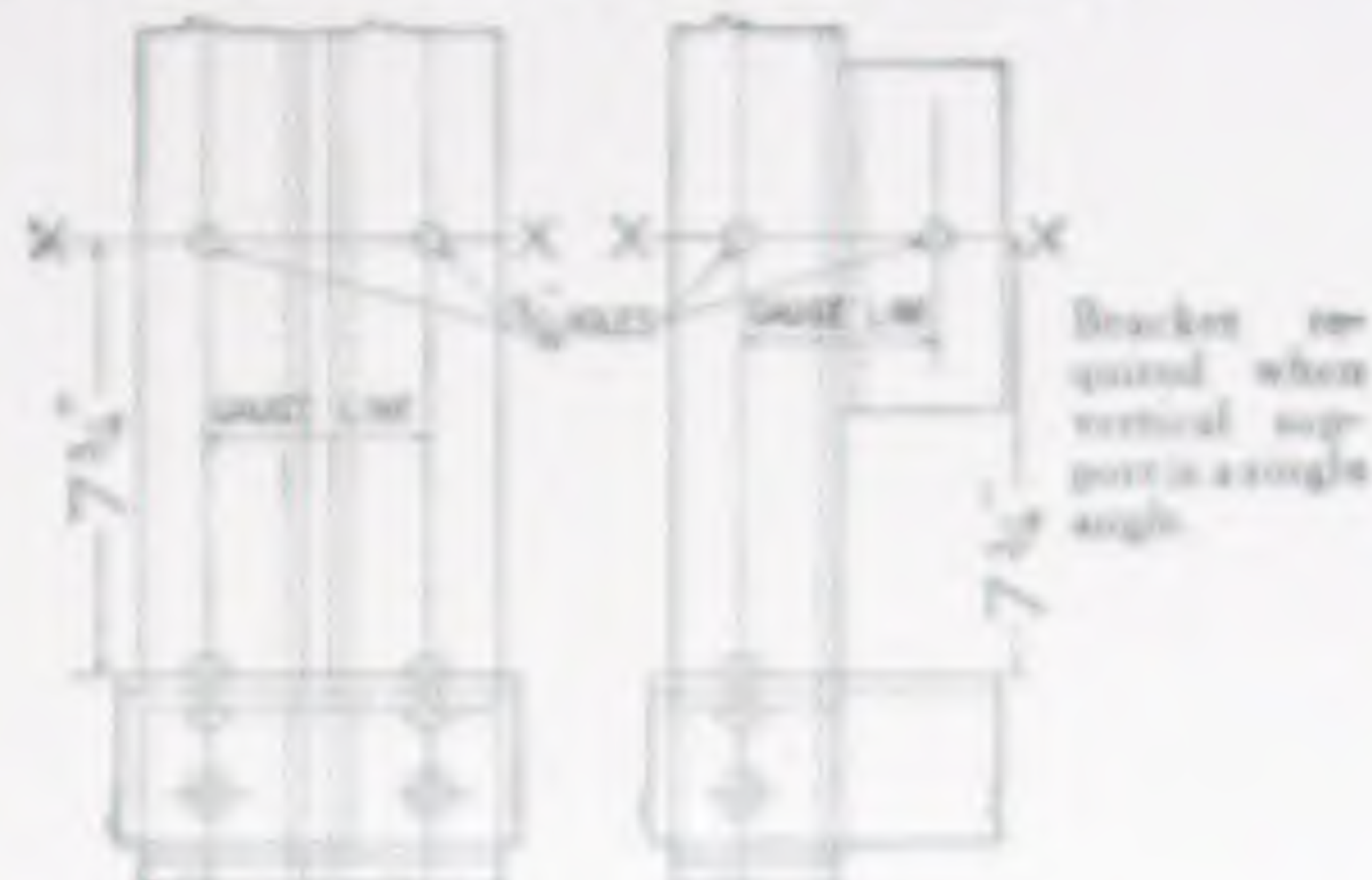
Dimensions

A	B	C	D	E	F
3' 0"	5' 9½"	3' 0"	2' 11"	1¾"	2' 11¾"
3' 0"	6' 9½"	4' 0"	3' 11"	1¾"	3' 11¾"
3' 0"	7' 9½"	5' 0"	4' 11"	1¾"	4' 11¾"
3' 0"	8' 9½"	6' 0"	5' 11"	1¾"	5' 11¾"

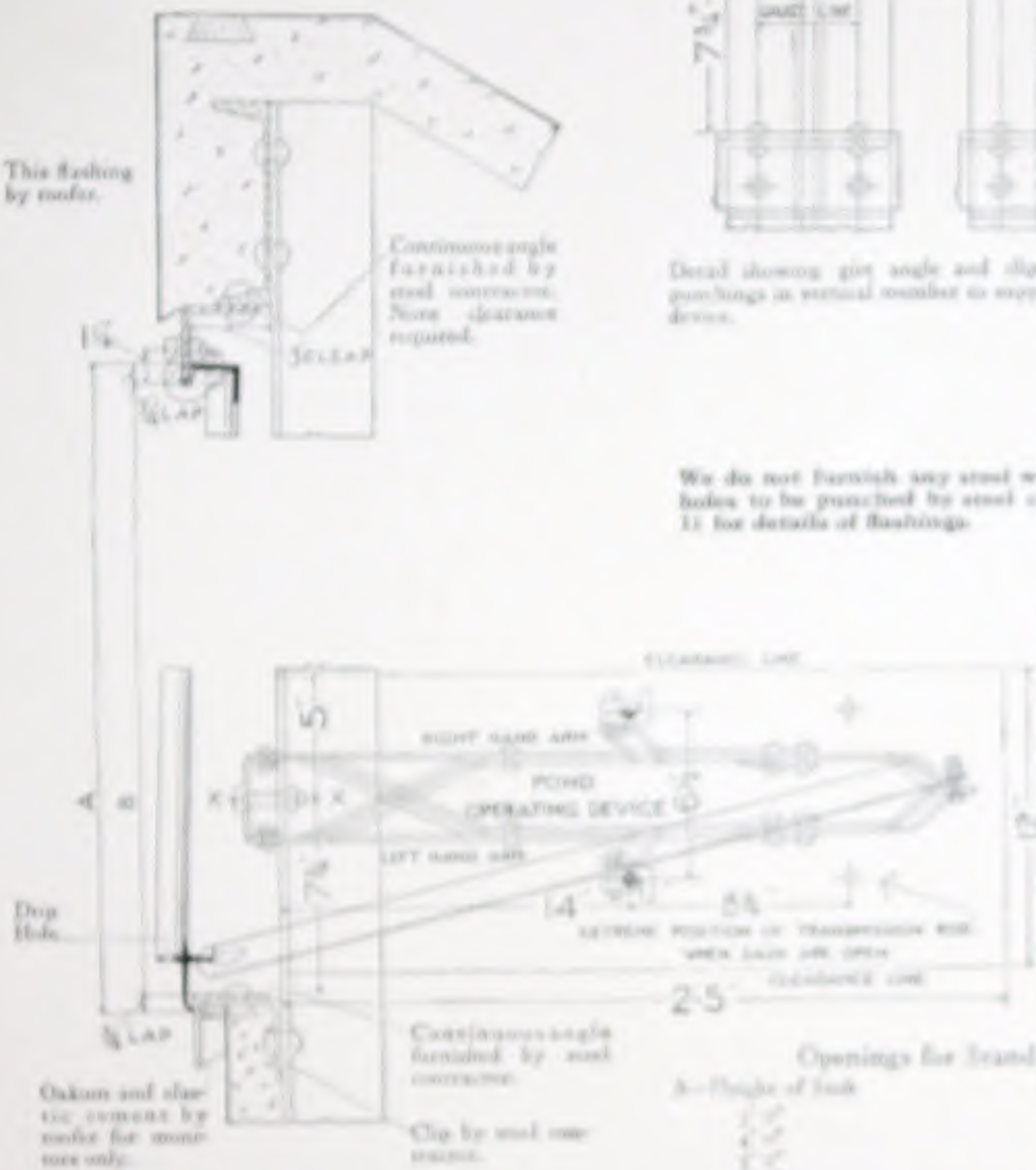
If A = 4 ft., increase B 1 ft.

In Monitors or Side Walls, One Sash High

Vertical Section One Sash High



Detail showing girt angle and clip at sill, and punchings in vertical member to support operating device.



We do not furnish any steel work or flashings. All holes to be punched by steel contractor. See page 11 for details of flashings.

Caution

All clearances shown must be strictly maintained. See "Dimensions and Clearances," page 6.

Openings for Standard Sash

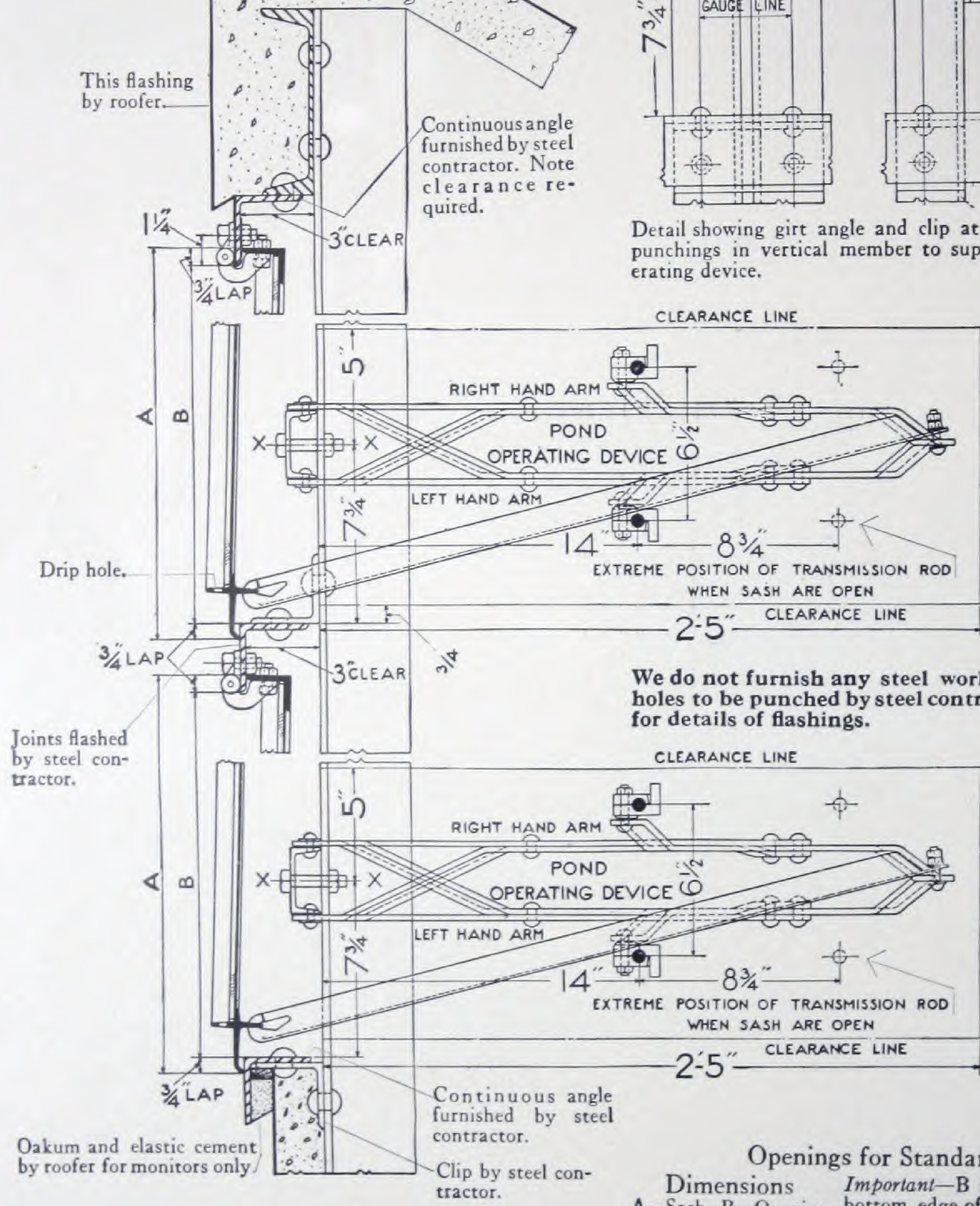
A—Height of Sash	B—Height of Opening
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

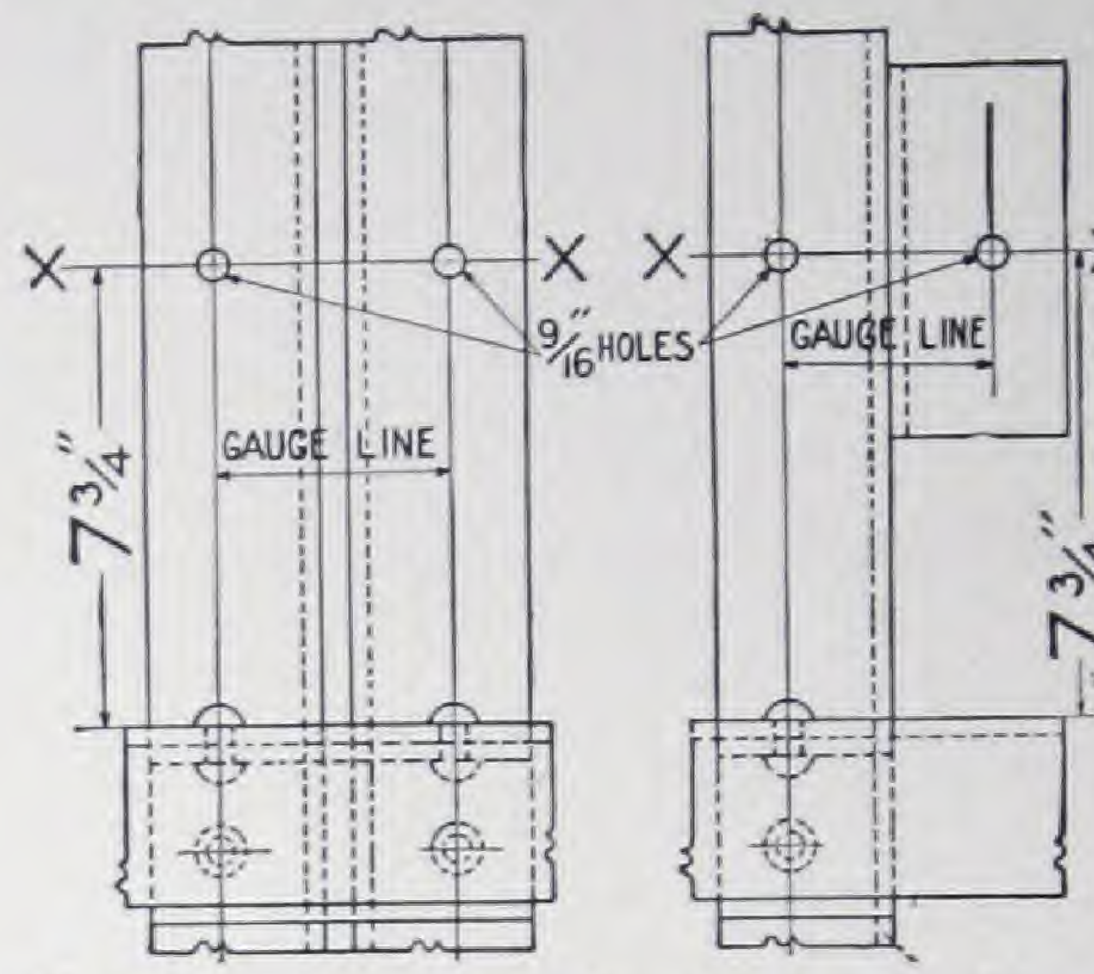
Vertical supports shown, for sash and operating device, are required on centers not greater than 10 feet.

Important—B is clear opening from bottom edge of angle above sash to upper outside corner of sill angle. This dimension must be carefully followed to ensure weather tightness without interference of parts.

In Monitors or Side Walls, Two Sash High

Vertical Section
Two Sash High





Bracket required when vertical support is a single angle.

Detail showing girt angle and clip at sill, and punchings in vertical member to support operating device.

Caution
All clearances shown must be strictly maintained. See "Dimensions and Clearances," page 6.

We do not furnish any steel work or flashings. All holes to be punched by steel contractor. See page 11 for details of flashings.

Vertical supports shown, for sash and operating device, are required on centers not greater than 10 feet.

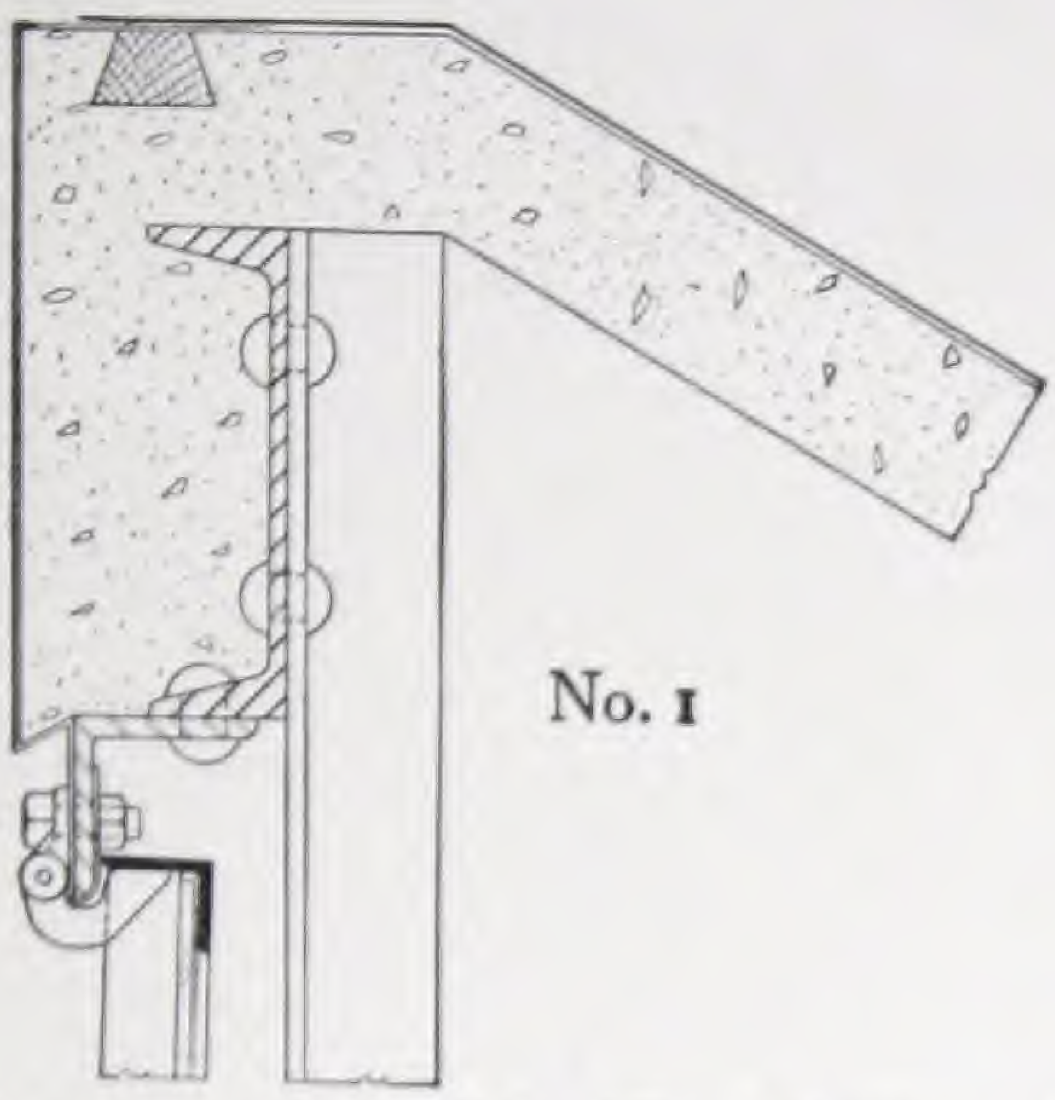
Openings for Standard Sash

Dimensions

A—Sash	B—Opening
3′ 0″	2′ 10½″
4′ 0″	3′ 10½″
5′ 0″	4′ 10½″
6′ 0″	5′ 10½″

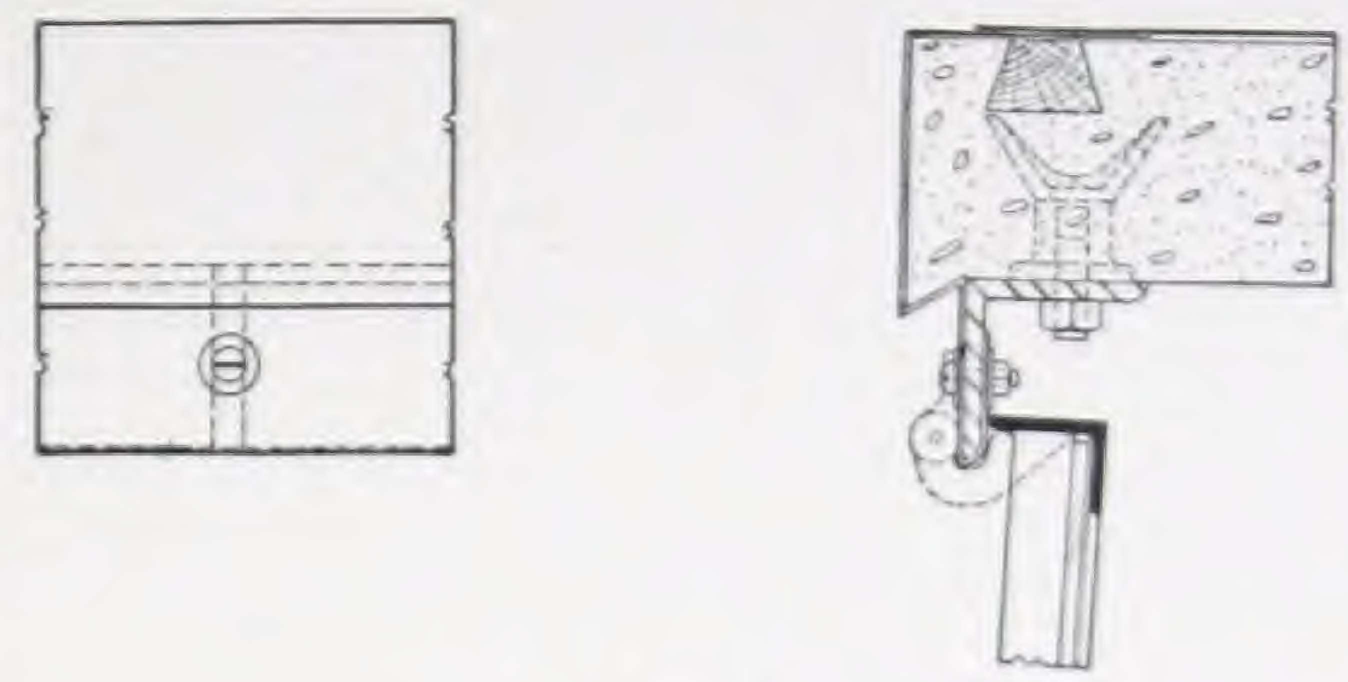
Important—B is clear opening from bottom edge of angle above sash to upper outside corner of sill angle. This dimension *must* be carefully followed to ensure weather tightness without interference of parts.

Details of Flashings



No. 1

For side walls, monitors and Pond Truss, also sawtooth and other sloping sash. Galvanized or copper flashing used, with the roofing cemented over flashing. Flashing is carried around angle girt and held at the joints of girts by bolts with washers and nuts as shown in view No. 2. Done by roofer.

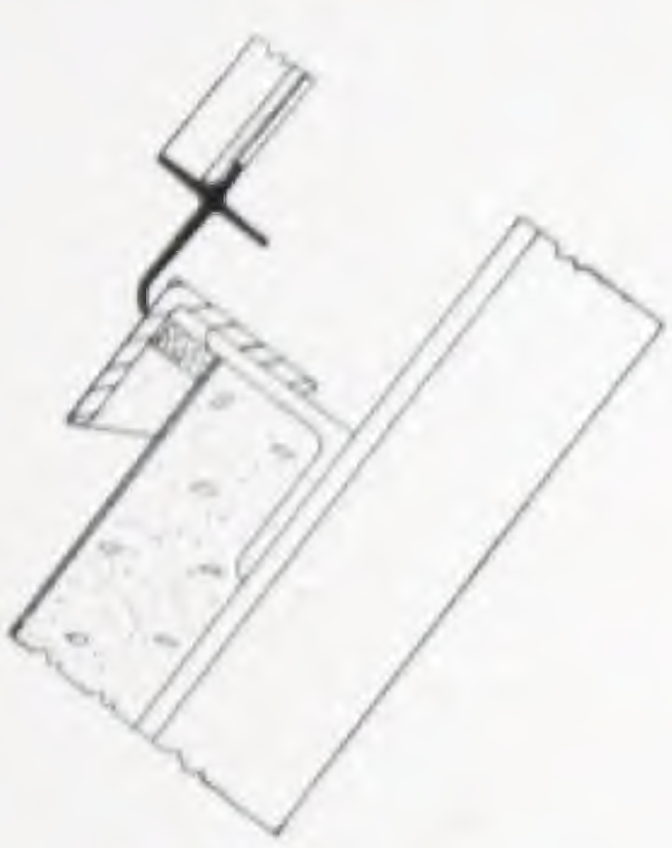


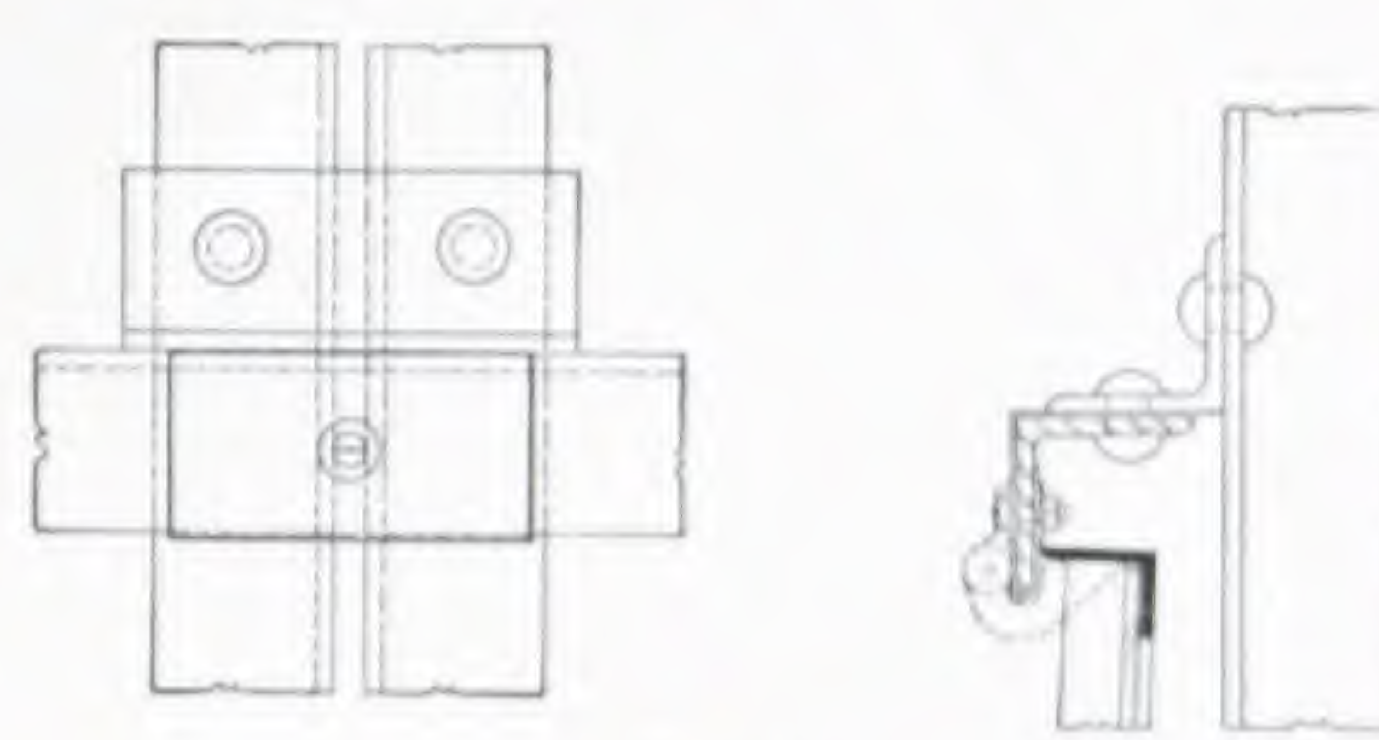
No. 2

For side walls, monitors and Pond Truss, also sawtooth or other sloping sash. Galvanized or copper flashing used, with the roofing cemented over flashing. Flashing is carried around angle girt, and held at the joints of girts by bolts with washers and nuts as shown above. Done by roofer.

No. 3

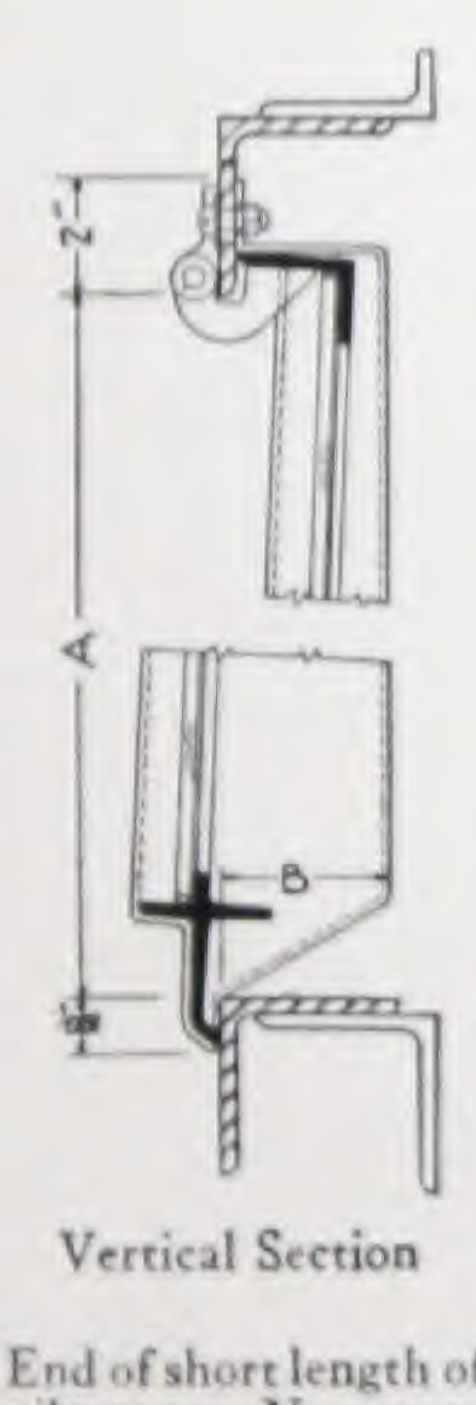
Sill of lower sash in sawtooth or monitor. Roofing paper is wedged by wood strip under the angle girt and the remaining space filled with oakum and elastic cement. Done by roofer.



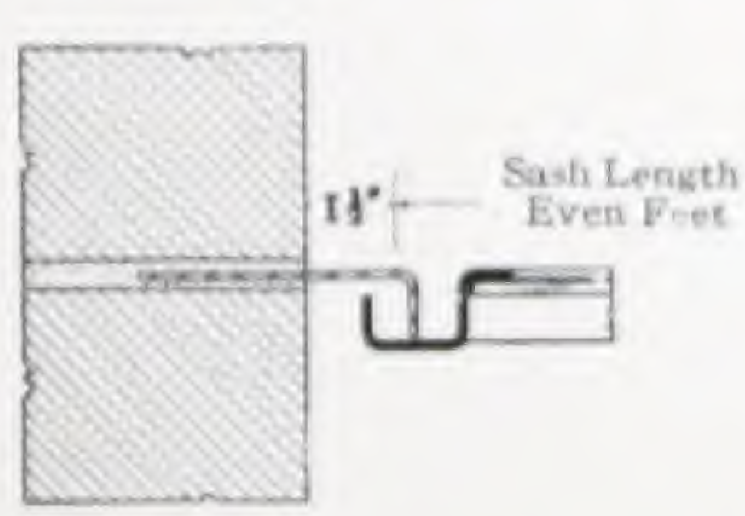


No. 4

Joints in intermediate angle girts, having sash above and below. These joints must be covered with galvanized or copper flashing, carried under the angle clip and bent around the bottom edge of the girts. A bolt with washers and nut is used as shown. Done by roofer or steel contractor.



Vertical Section



Horizontal Section

No. 5

DIMENSIONS

Sash No.	A	B
3	34½"	Face of steel work to brick joint. Specified by architect.
4	46½"	
5	58½"	
6	70½"	

End of short length of Pond Continuous Sash between brick pilasters. No storm panel used. Special side rail used, overlapping a 12-gauge bent steel plate set in brick. Plate formed by Lupton to suit architect's specification. See table.

No. 6

Horizontal section of sash, showing expansion joint, stationary storm and end panels, and galvanized or copper flashing. The end of the flashing is nailed down on a bed of putty. Flashing by roofer. Note the formed end rails of operated sash by which air leakage is prevented without extra parts.

Hinge Punching in Girt Angles

Holes to receive bolts for hinges are $\frac{9}{16}''$ diameter, and are punched by steel contractor on a gauge line $1\frac{1}{4}''$ up from the toe of the girt angle to which the sash are supplied. See sketch in upper left corner of Group C diagram below.

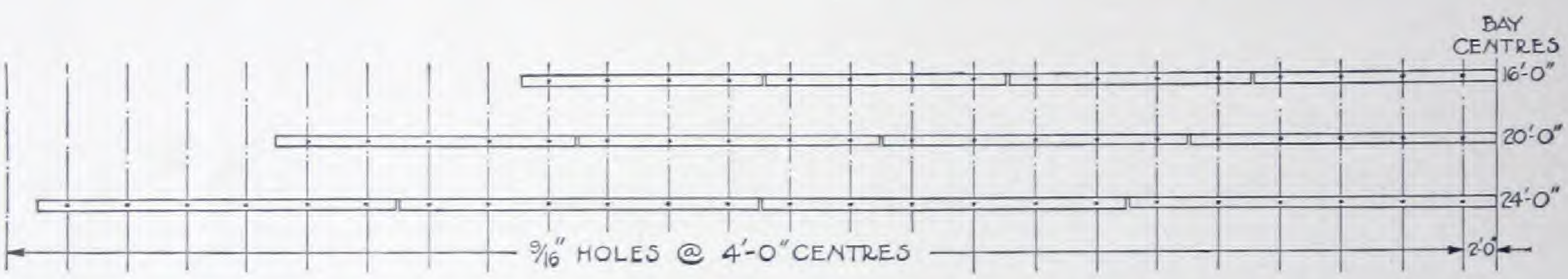
Pond Continuous Sash are manufactured so that the first hinge hole is two feet from the right-hand end of the line of sash, facing the outside of the building. The succeeding holes are spaced on $4'\ 0''$ centres.

The diagrams "A," "B," and "C" show the spacing of these holes for girts of different lengths: the chain lines indicate centres of punchings.

Girt angles are shown with joints on bay centres, in conformity with standard practice. The contractor should omit $\frac{9}{16}''$ holes where hinge punching coincides with joints in girt angles: these holes will be located and punched off centre by sash erectors.

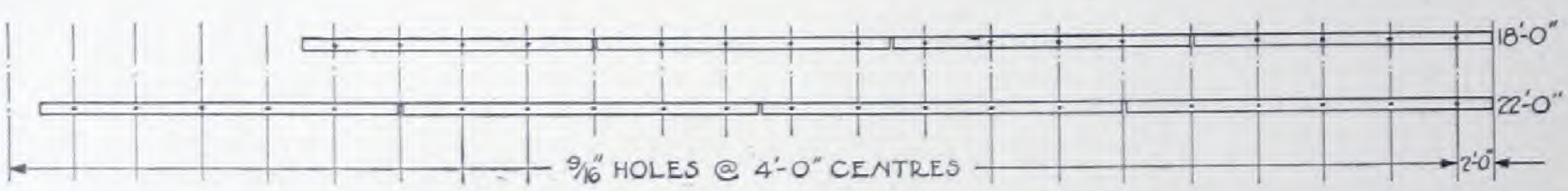
Twenty-foot bay centres are most desirable from the standpoint of steel construction. Pond Continuous Sash are standardized in 20-foot lengths.

Scale of diagrams, $\frac{1}{16}'' = 1'$.



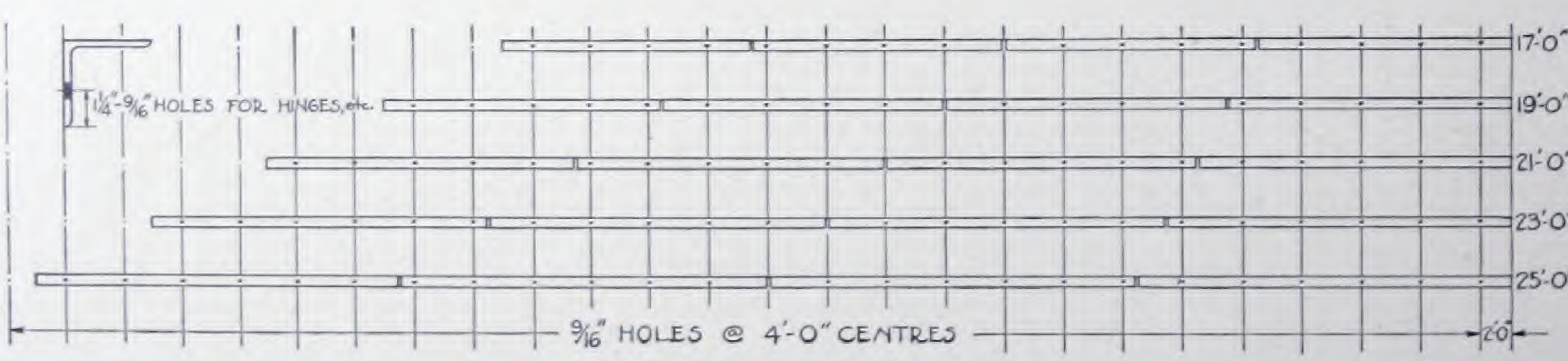
Group A

Shows typical layout of hinge punching for buildings with columns spaced 16, 20 and 24 feet on centres. These girts are identical for all bays on both sides of the building.



Group B

Shows typical layout of hinge punching for girt angles with columns spaced 18 and 22 feet on centres. These girts are punched right and left, so that two punchings, using the right and left in pairs, are sufficient.



Group C

Shows typical layout of hinge punching for girt angles with columns spaced 17, 19, 21, 23 and 25 feet on centres. This group should be avoided, as four styles are necessary, using two rights and two lefts.

Pivoted Type

Comparison

We recommend Pond Continuous Sash, top hung, and make the Pivoted Type only when required. Snow and rain strike this sash when open and are blown over the top, while the top hung type is weatherproof under all conditions and is easily controlled by Pond Operating Device in long lines, with the varying load of the sash offset by spirals and counterweights. The Pivoted Type increases the cost of the building by reason of the additional steel required for the roof cantilever and for continuous members to which sash is pivoted. We can demonstrate that better ventilating results, under all weather conditions, are obtained by the use of Pond Continuous Sash, top hung.

When a ventilating roof is placed over product or equipment liable to damage by water, a genuinely weather-proof type of roof sash is especially necessary to permit ventilation in all weathers. Such protection is given by the top-hung type.

First Installation

The original installation of Pond Continuous Sash, Pivoted Type, was 70,000 square feet, furnished by us in 1909 for the Pullman Company, in their steel freight-car plant at Pullman, Illinois.

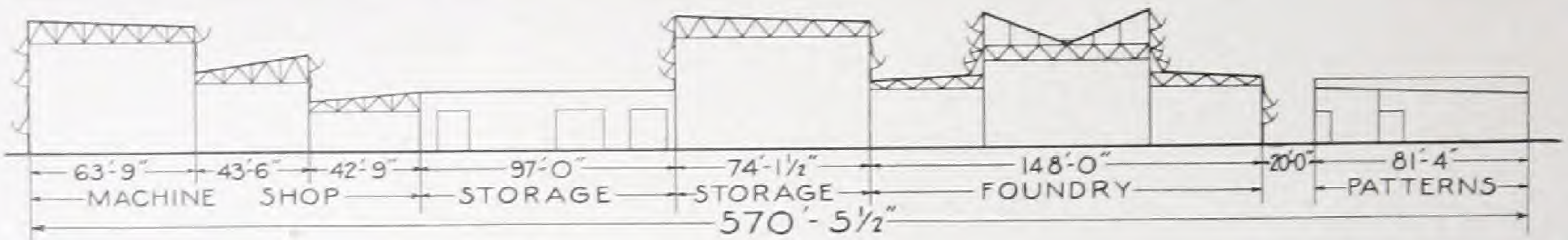
Specification

Malleable pivots with bronze pins are used, and all other features, including welded joints and sections, are the same as for top-hung sash shown on preceding and following pages.

Mr. W. E. Wood
Construction Engineer

Ford Motor Works
Extension to Machine Shop
Detroit, Mich.

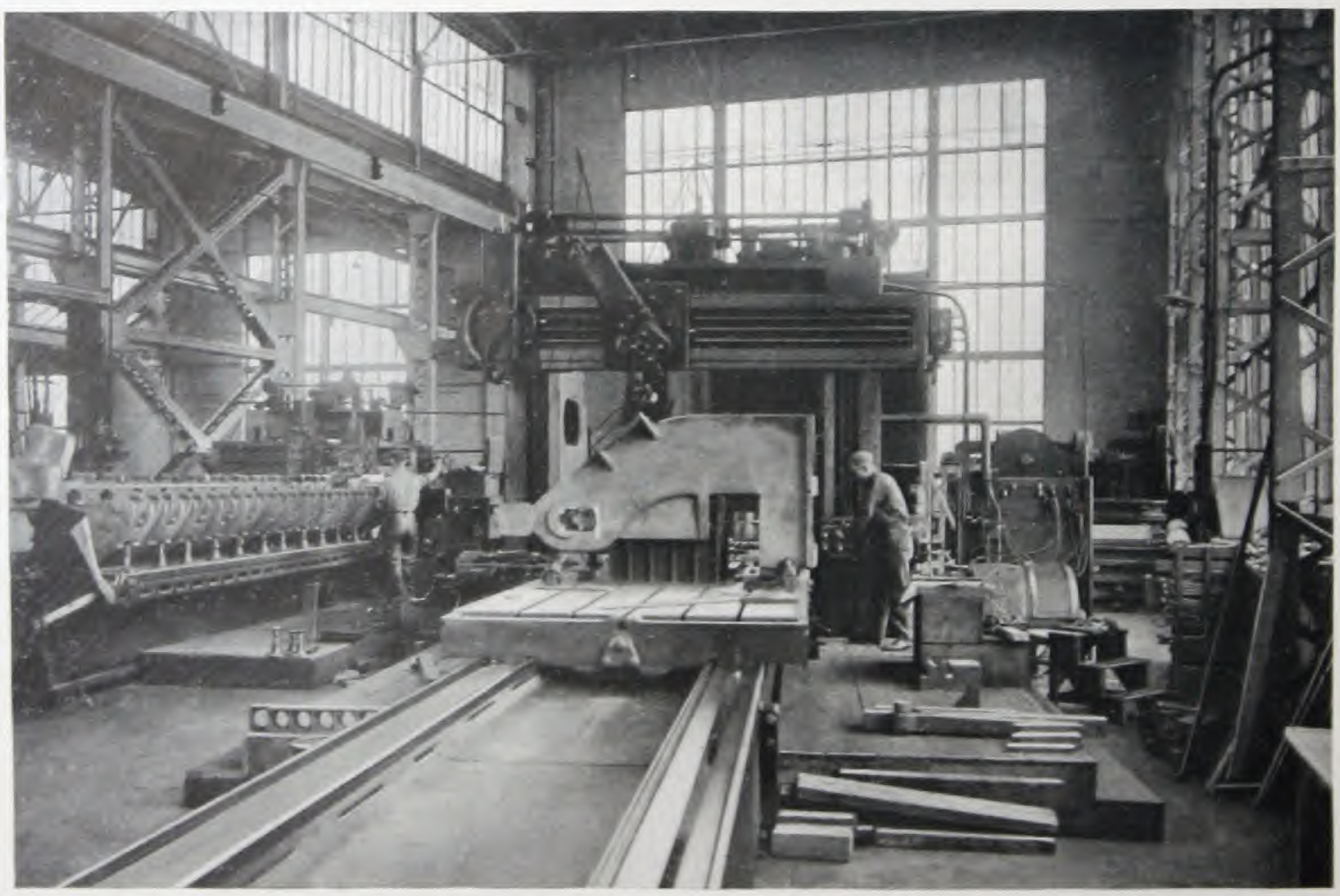
Interior view of installation of Pond Continuous Sash, Pivoted Type



Frank D. Chase, Inc.
Industrial Engineers

Consolidated Press Co.
Hastings, Mich.

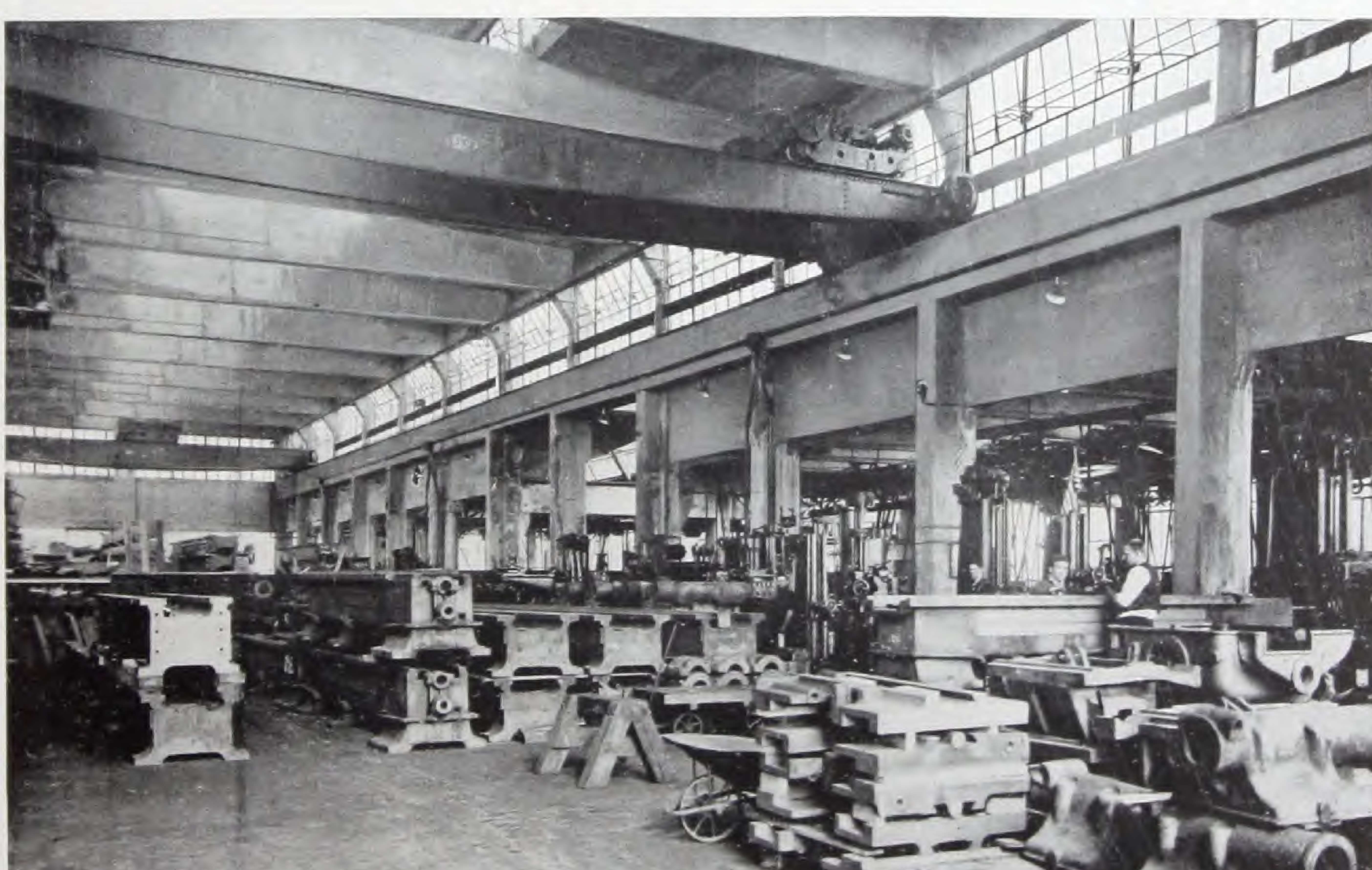
A harmoniously planned modern plant, comprising machine shop, material storage building, foundry, pattern shop and office building. Pond Continuous Sash used throughout except in the office building and part of pattern shop. Machine shop (to left in picture) has three roof levels, the two lower of which slope upward from the adjoining walls, thereby permitting more sash to be used in those walls, with better lighting effect. In the outside walls of the machine shop, the lower lines of sash are in short units, each with two peg stays. Lines above these are stationary, except the top line in each end wall and those overlooking the "lean-from" roofs, which are controlled by Pond Operating Device with spirals and counterweights. View below is taken against front (northwest) end wall.

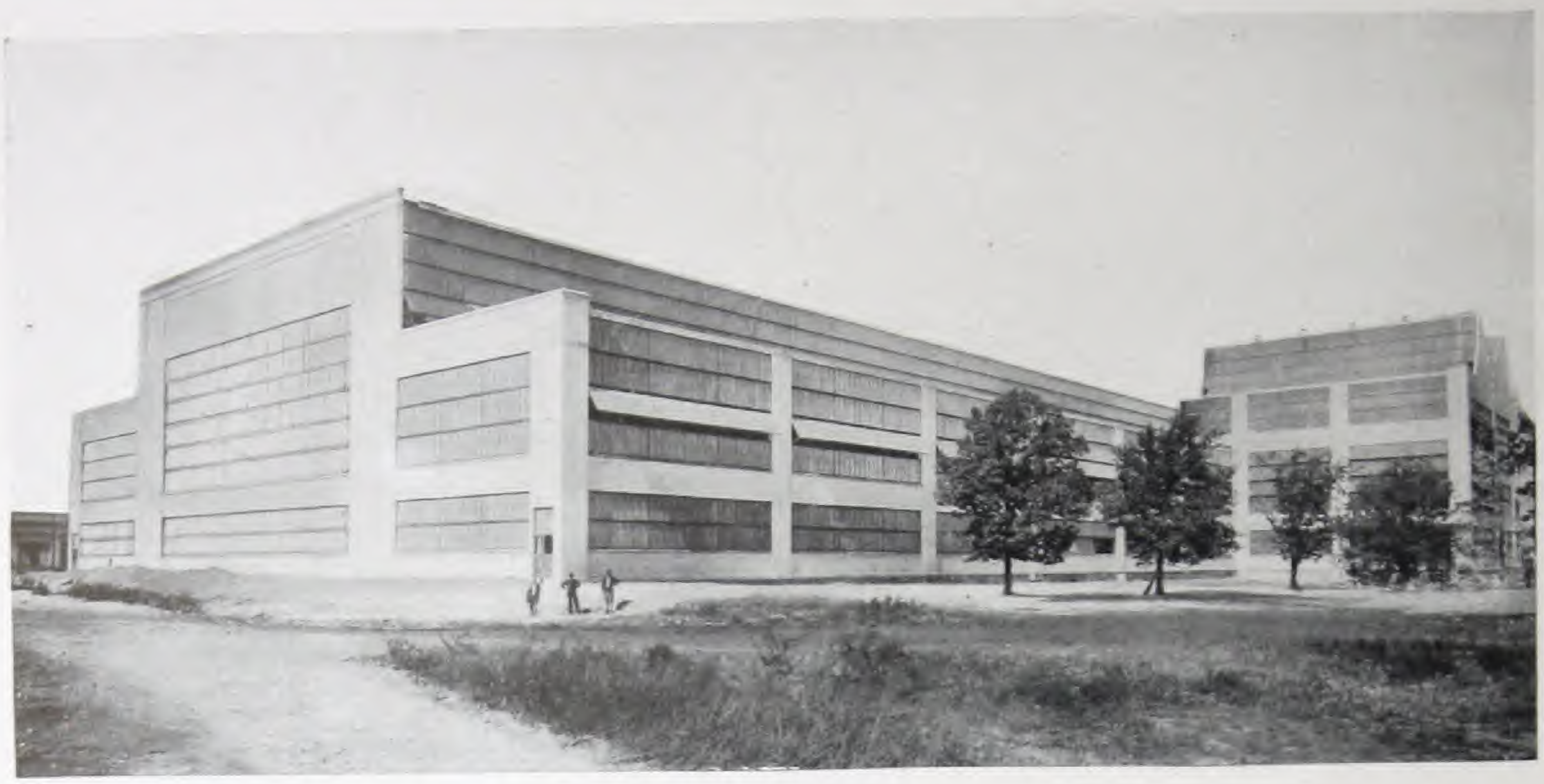


Mr. H. S. Byers
Architect

Betts Machine Company
Rochester, New York

Machine Shop, showing use of Pond Continuous Sash and Lupton Counterbalanced Sash. In the upper side walls the Pond Continuous Sash is set in short lengths between pilasters, with the Pond Operating Device running across the pilasters. The sawtooth form of roof over the side bays gives additional light. The large steel doors in this building are likewise a Lupton product. See catalogue of Lupton Special Steel Tube Doors.





H. M. Lane Company
Consulting Engineers

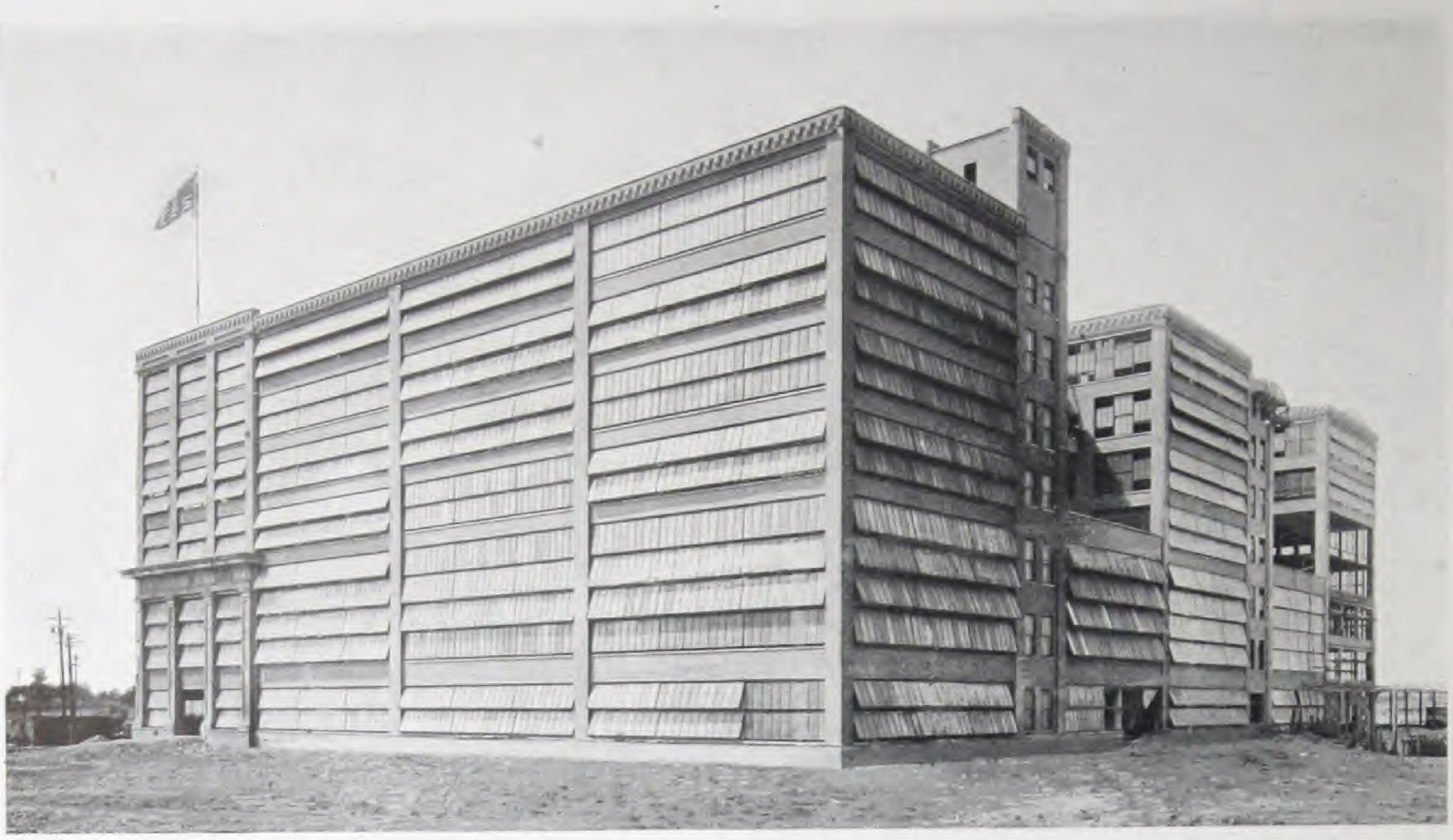
Buick Motor Company
Flint, Mich.

This foundry has a main floor 240 feet wide, 470 feet long, with a wing at one end containing four cupolas. Both main and wing roofs are Pond Trusses. Under the main floor is a ground floor used for cleaning and storage. Sand dumped from the flasks goes through gratings to the ground floor and the hot castings go down by chutes. Pond Continuous Sash used throughout, with Pond Operating Device, Motor Driven.

George S. Rider & Company
Engineers

Cleveland Co-operative Stove Co.
Cleveland, Ohio

This Pond Truss building is 140 feet wide, 450 feet long. Pond Continuous Sash used throughout. Roof lines each 6 feet high, 220 feet long, operated by Pond Operating Device with spirals and counterweights. Side wall sash similarly operated, but part of it in shorter lengths. Lower view shows interior of same building. The lighting is so good that the electric lights are seldom or never used, and are omitted in a 500-foot extension erected after these photographs were taken. See cross section in front cover.



Osborn Engineering Company
Engineers

Firestone Tire & Rubber Company
Akron, Ohio

Plant No. 2, so far as at present erected. Ground plan forms a grid, with central "backbone" and lateral wings. The main entrance (left in picture) is at east end of "backbone." Three north wings have been erected; the plant will be extended by adding south wings and by extending "backbone" to west, with wings. Pond Continuous Sash in outside wall discharges the heat and fumes of rubber manufacture without danger of rain spoiling work near windows. Lupton Counterbalanced Sash used in walls overlooking light courts. Second story is carried across light courts with sawtooth roofs, using Pond Continuous Sash. See page 19 for roof treatment of wings.

Lower view was taken in Firestone Mechanical Building, using same arrangement of Pond Continuous Sash. It gives uniformly distributed fresh air with full protection against rain.

Messrs. Zettel & Rapp
Architects

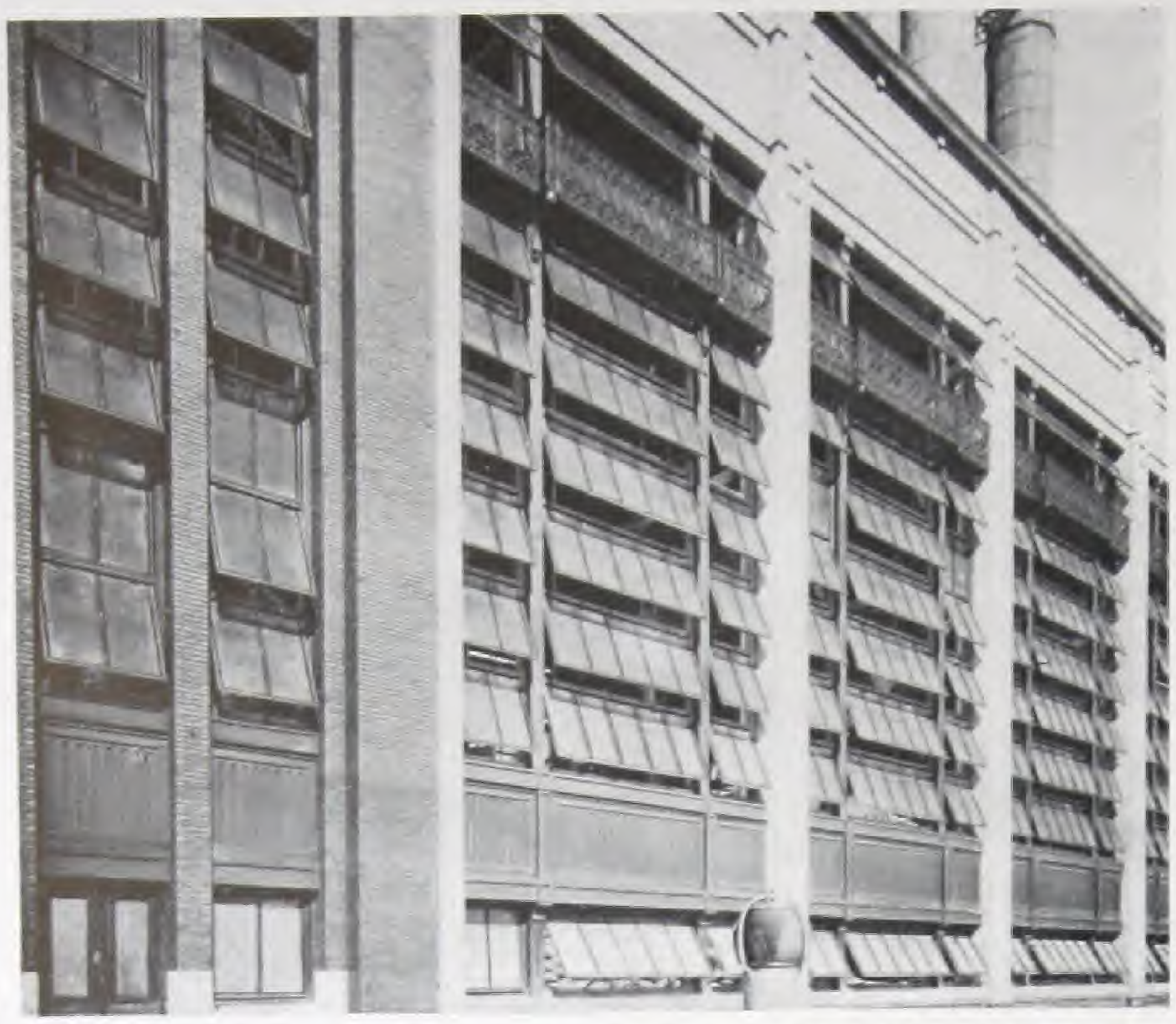
LeBlond Machine Tool Company
Cincinnati, Ohio

Sawtooth roof of machine shop, with rear of office building in distance. Pond Continuous Sash used in sawtooth, hand operated by Pond Operating Device.

Osborn Engineering Company
Engineers

Firestone Tire & Rubber Company
Akron, Ohio

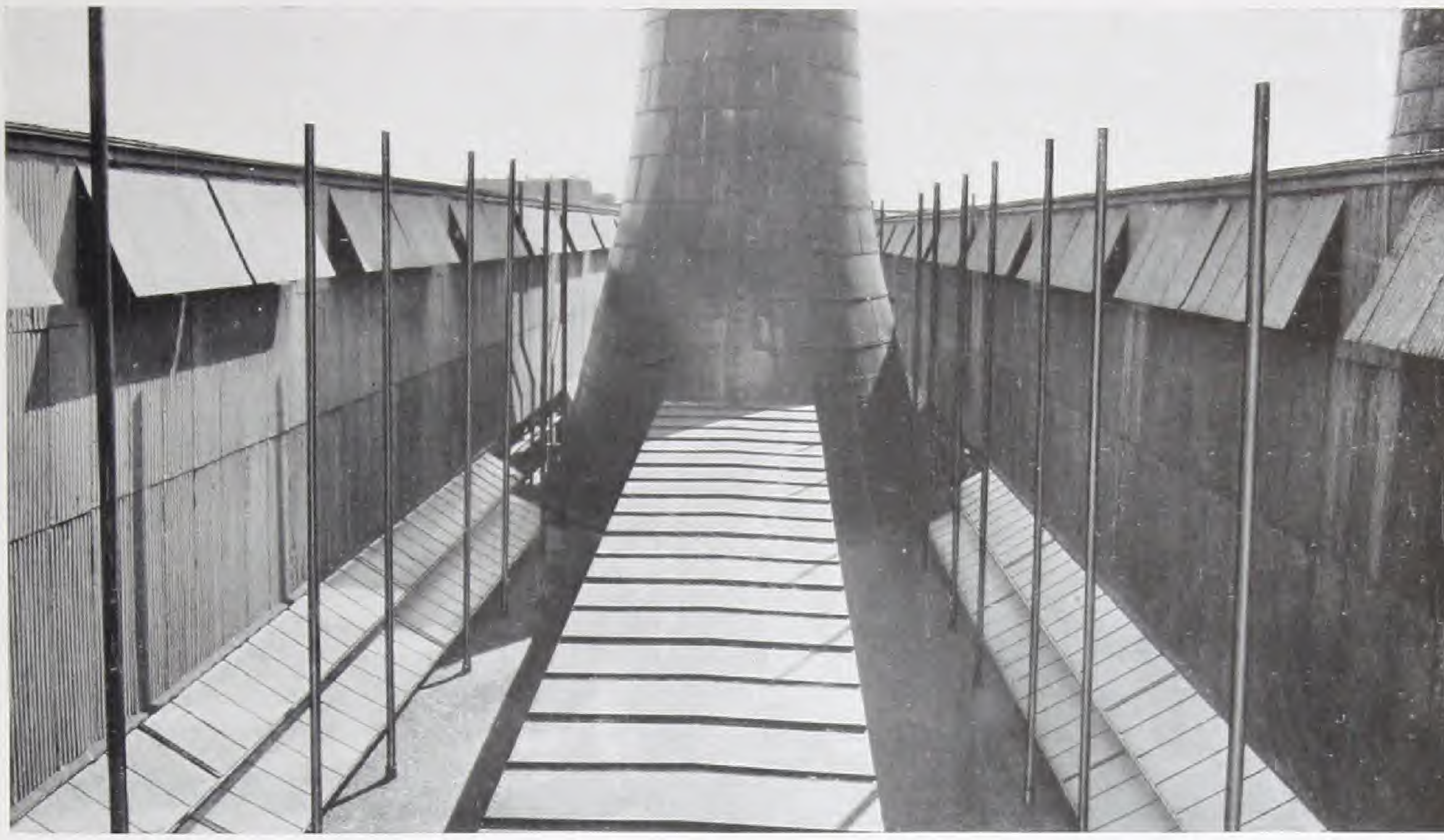
The top floor of each wing of Plant No. 2 is roof lighted, as this view shows. The wings run north and south, thereby securing maximum morning and evening light. Pond Continuous Sash and Lupton Counterbalanced Sash used. See general view of this building on page 18.



Mr. W. B. Mayo
Chief Engineer

Ford Motor Company
Detroit, Mich.

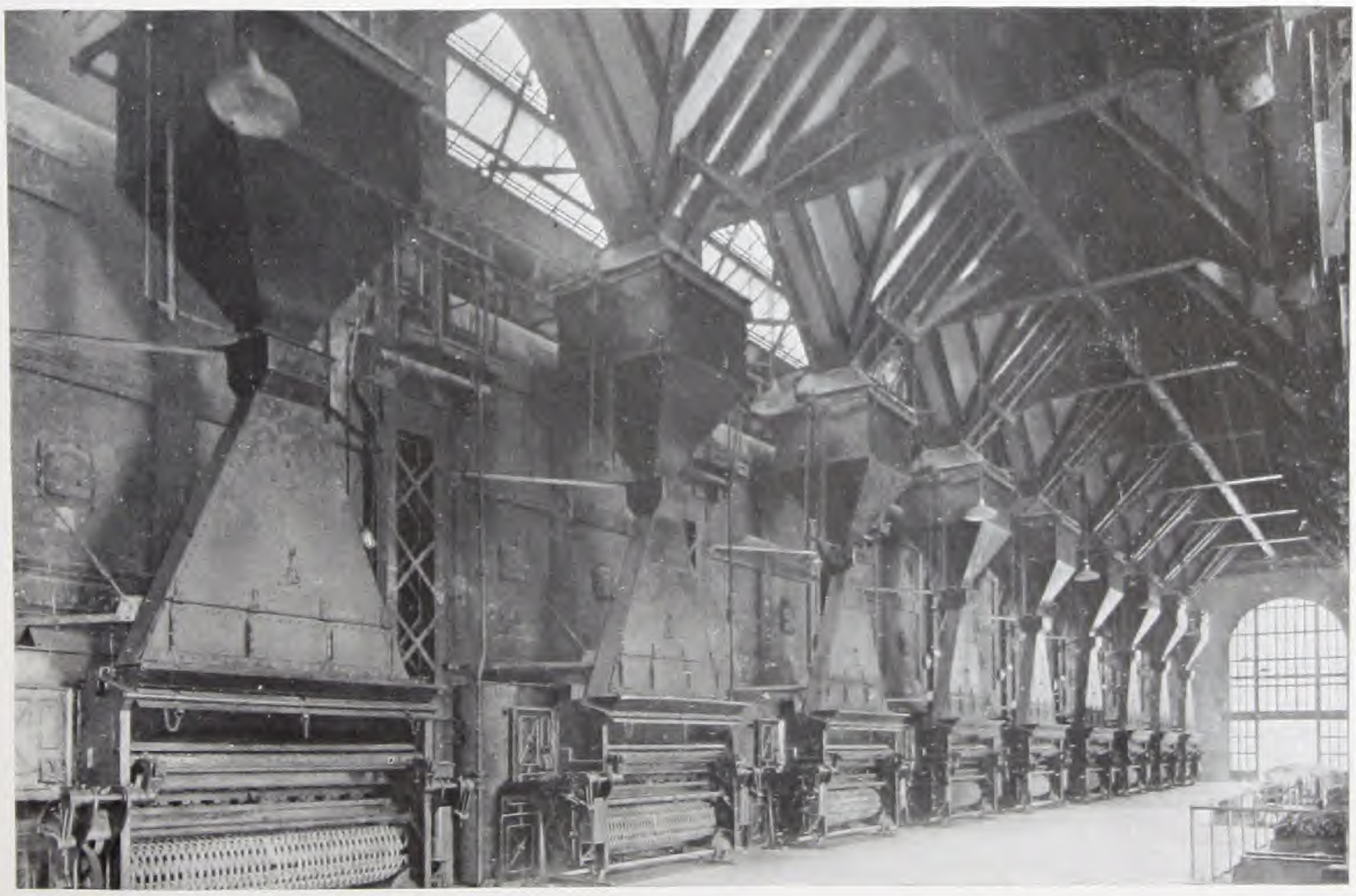
The artistic possibilities of Pond Continuous Sash for power houses are well shown in these views of the Ford Motor Company power house. The sash units are hinged at the top, connected by vertical arms and controlled simultaneously for each group between pilasters by one Pond Operating Device. A heavy horizontal bar, attached to the fourth sash from the bottom, counterbalances the sash so that they hang normally about 15 degrees open; this opening is increased or reduced by the operating device. The heavy members, welded assembly, and general ruggedness of Pond Continuous Sash render it well suited to power house service.



Mr. R. L. Cobb
Chief Engineer

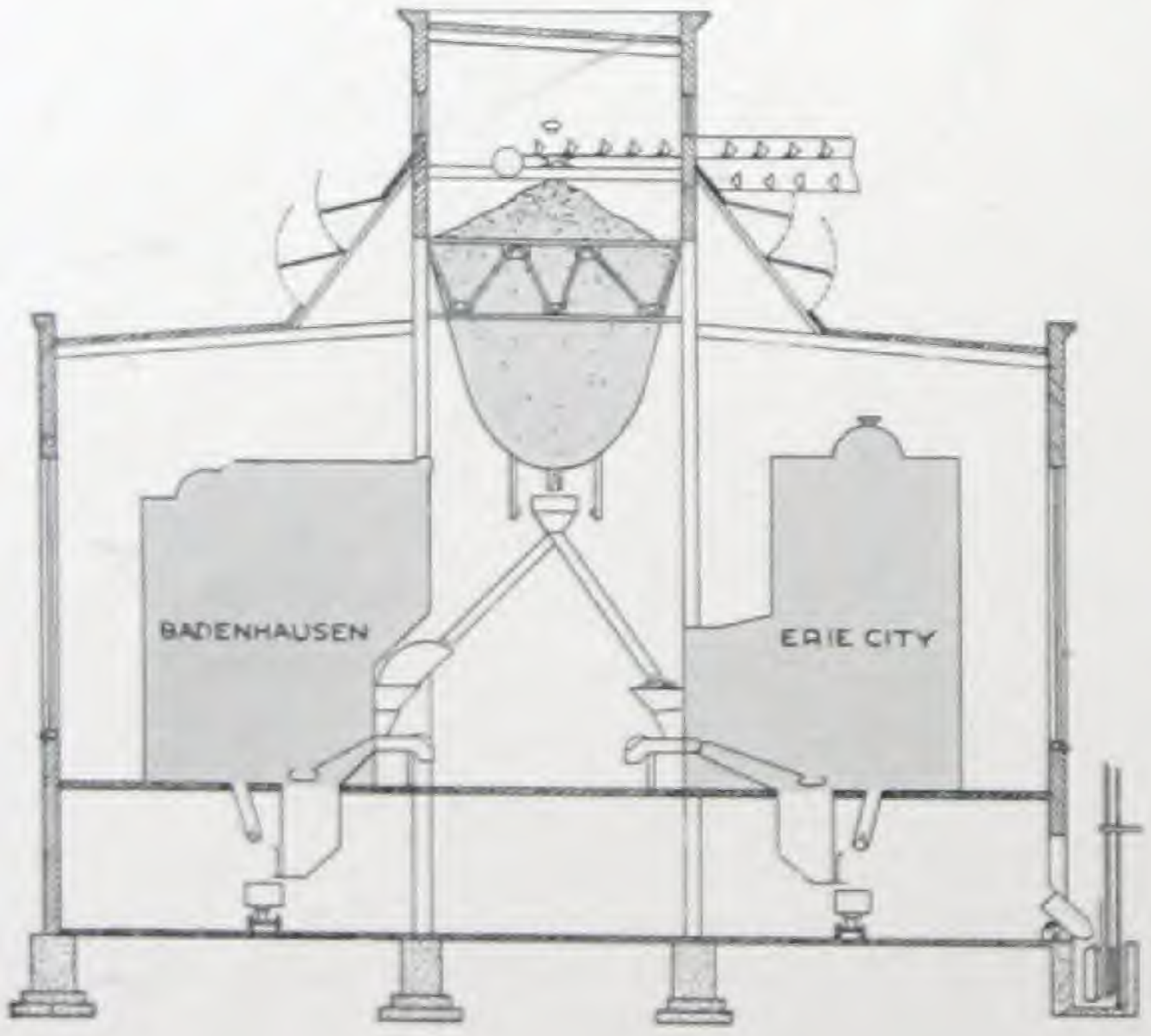
Lake Street Power House
Cleveland Electric Illuminating Company, Cleveland, Ohio

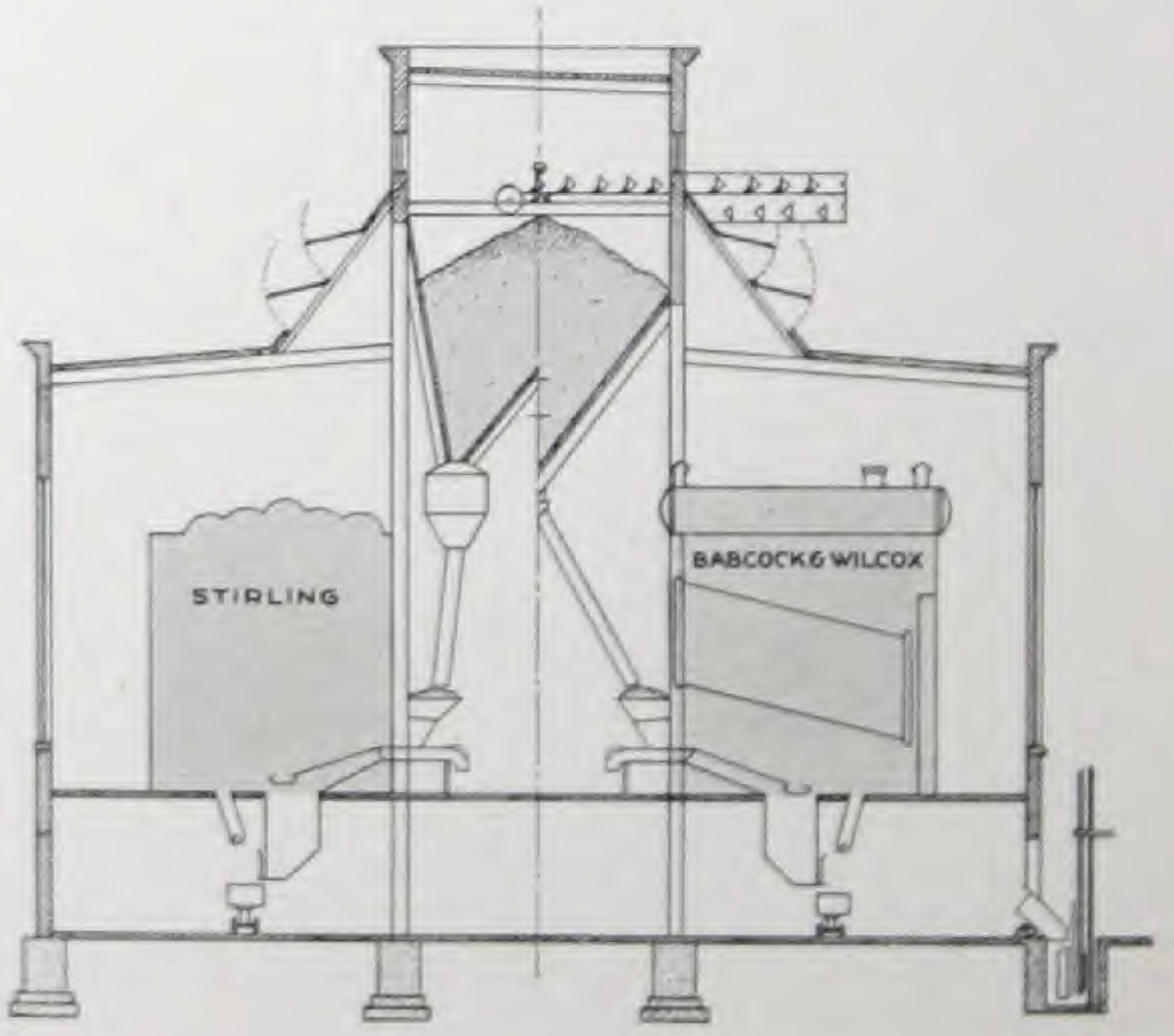
The use of a low roof level over the boilers, and a high roof level over the coal bunkers, permits lines of Pond Continuous Sash to be placed between the boiler roofs and the bunker walls, thereby giving light and ventilation to the firing aisle. The smoke ducts to the stacks are carried above the boiler roofs as shown. This boiler room, with 54 boilers and 4 firing aisles, is well lighted and comfortably cool in all weathers, although one end of each aisle is closed by the turbine room wall. See page 22, lower right view.



Exterior and interior views of small power house, showing use of Pond Continuous Sash. As this sash is wholly outside the wall line when open, it gives better weather protection than center pivoted sash; and its ruggedness and low cost are further advantages.

The two views below show typical arrangements of medium size boiler houses for securing light and ventilation in the firing aisle where the end walls do not suffice. The coal bunker may be of any well-known type; that shown with the Sterling boiler is of the form shown in the interior view of the Lake Street Power House, page 21.





POND OPERATING DEVICE

(Patented by Clarke P. Pond, and Patents Pending)

The Pond Operating Device was designed to operate long lines or groups of sash with the least possible friction, and with maximum leverage exerted in the position of maximum load.

Minimum friction is secured by the tension principle of transmission. A pair of tension rods, connected at their ends by chains passing over a sprocket wheel and an idler pulley respectively, are connected to the sash at intervals by compound levers and thrust rods. The sprocket is operated by worm and gear cut from solid steel and running in a dust-proof case packed with grease. Ball bearings are used on the worm shaft. The bearings in the levers and idler are phosphor bronze. The tension rods are subject to no lateral thrust and do not require to work through sliding bearings or guides.

Motion is transmitted "around the corner" from both tension rods to the sash rods by the compound levers above mentioned. These levers are pivoted to, and carried by, brackets bolted to upright structural members just inside the sash. As the sash opens they swing through an arc of a circle, thereby changing the position and thrust of the sash rods from an acute angle with the sash, when the latter is closed, to nearly a right angle when it is fully open.

Thus a given movement of the operating chain produces a quick movement of the sash when the latter starts to open and offers comparatively little resistance, and a slower movement with direct thrust when the load due to lifting the sash approaches maximum. Since the thrust rods are operated by both tension rods, and therefore work in opposite directions, the lateral components of the thrust against the sash neutralize each other.

The foregoing applies to top-hung sash, part of whose weight must be lifted to open it. In the chapter on Pond Continuous Sash are stated the reasons why we recommend the top-hung type, namely, its far more effective protection against weather, and the lower cost of structural work needed to support it. To realize these advantages the operating device must be highly efficient. It is the efficiency of the Pond Operating Device, and its nearly fool-proof character under working conditions, that have made it so successful.

A modified form of Pond Operating Device, with "X-arm" levers, is applied to centre pivoted sash. In this case the maximum effort is that required to start the sash when shut, and the design provides for this.

Mechanism

The worm and gear are cut from forged steel. They lock the sash in any position, preventing slamming and breakage of glass.

The tension rods are steel in 20-foot lengths, with hot headed ends connected by malleable barrel couplings. The complete line will sustain a load of 14,000 pounds.

Because the tension rods float rather than slide, side friction and need of frequent oiling are eliminated. A device that "*must*" be oiled is liable not to be; the Pond Operating Device needs only fresh grease in the gear case at 10-year intervals.

Two stop bars, one at each end, are connected to the sprocket chain. They prevent damage from continued operation of the hand chain after the sash are fully open or shut.

The three illustrations on page 26 show the movement of the levers and sash rods when opening top-hung sash.

Except for an occasional coat of paint, and grease in the gear case, the Pond Operating Device requires no maintenance. It will last as long as the building.

Idler

Power

OPERATING GEAR AND TRANSMISSION BRACKET

Used at opposite ends of each line of sash

Width of Opening

The value of an operating device is measured by the ventilation it affords under practical working conditions. If rapid opening of the roof sash—as in a foundry after pouring off a heat, or in a factory when a shower ends—requires many men to stop work and operate hand wheels or chains, many sash lines are certain to be neglected. The men will endure discomfort sooner than exert themselves.

The great value of the Pond Operating Device is that it gives a wide opening, gives it quickly, and absorbs the least amount of power in friction when operating long lines of sash. Following are guaranteed openings of Pond Continuous Sash with the Pond Operating Device.

Table of Openings for Sash Controlled by Pond Operating Device

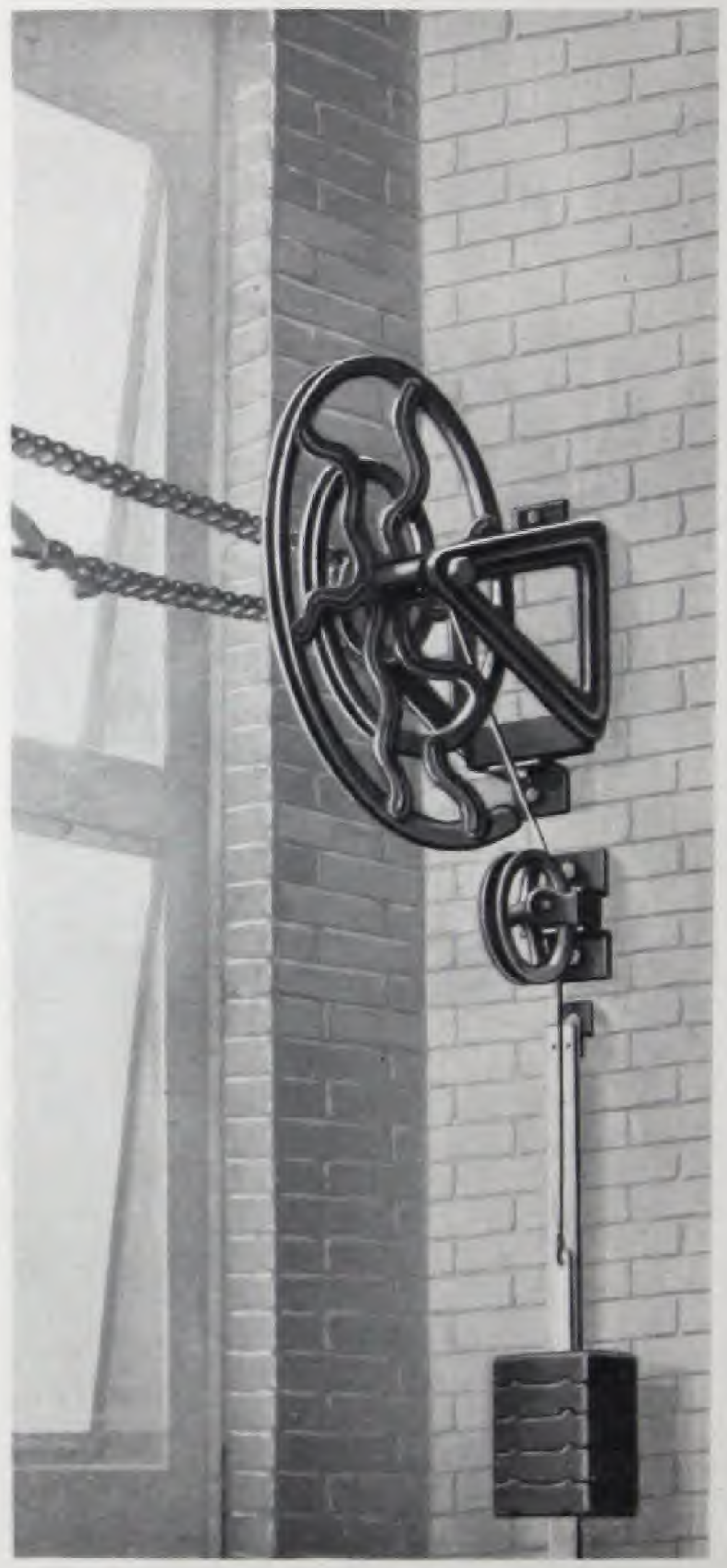
Horizontally pivoted sash 60°
Vertically pivoted sash 90°

3'	high	top-hung	continuous	sash	46°	or 28"
4'	"	"	"	"	47°	or 38"
5'	"	"	"	"	42°	or 48"
6'	"	"	"	"	36°	or 44"

Spirals and Counterweights

A very desirable feature of the Pond Operating Device, when applied to long lines of sash, is the use of spirals and counterweights to balance the increasing load of top-hung sash when opened. By using them the length of "run" which may be operated by one hand chain is fully doubled; hence the time needed for opening several lines is reduced one-half, as compared with dividing each line into two "runs" with separate gears and chains.

Owing to the saving in time, spirals and counterweights are recommended wherever



Spiral and Counterweight

Spiral and Counterweight used in place of idler to balance long lines of sash. The weight winds up as sash closes; its descent raises sash. Radius of spiral increases as sash opens.

their use will save dividing the lines, or will make rapid, instead of slow, work of pulling the hand chains for the last stage of opening.

The principle of the spiral is to apply a variable pull to the tension rods, sufficient to balance the load of the sash, so that the operating gear has only to overcome friction. The spiral is substituted for the idler pulley, and the counterweight is hung on a steel cable which passes over the spiral. The changing radius of the spiral increases or decreases the leverage of the counterweight in proportion to the sash load. The counterweight, as it descends, raises the sash. A guide and automatic safety device are furnished with the counterweight.

Spirals and counterweights should be used with Pond Continuous Sash in vertical lines longer than 200 feet and in sloping lines longer than 100 feet. *They are furnished only when specifically included in our proposal and at an additional cost.*

Parts Not Furnished by Us

All structural supports for the Operating Device are to be furnished by the structural contractor. This includes supports for the power, for the bracket carrying the spiral and counterweight, and for the compound levers attached to the transmission rods. These may be of the form here shown, or of special forms. We furnish detail blue prints as needed.

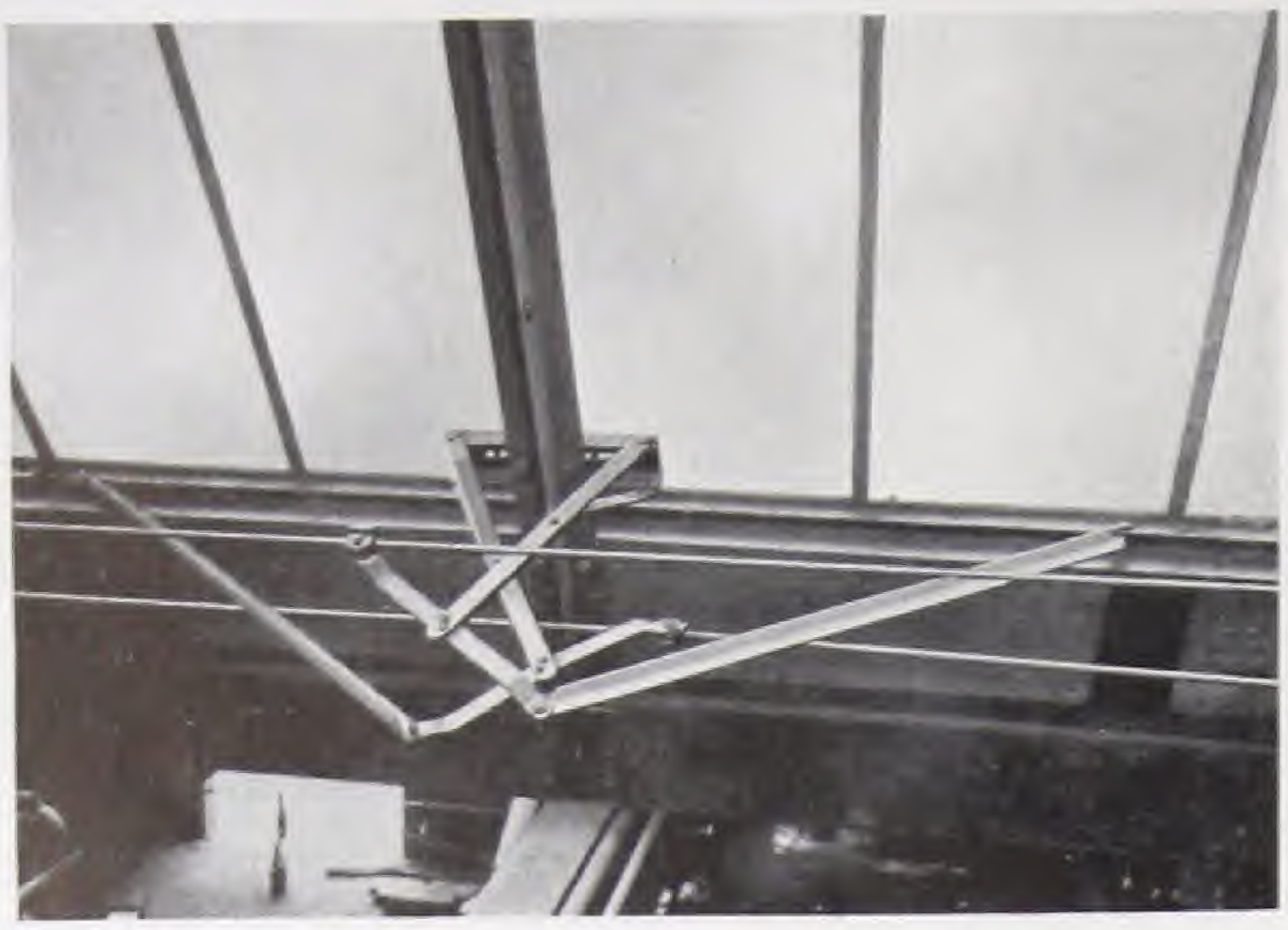
Specification

Specify Pond Operating Device furnished and erected complete by David Lupton's Sons Company, with worm and worm wheel cut from solid steel, enclosed in dustproof case and running in grease; ball bearings on worm shaft; power transmitted by tension; arms of design to give greatest leverage at peak load for the type of sash operated; phosphor bronze bushings in hinged connections throughout; hot headed steel transmission rods connected by malleable barrel couplings; device controlling top-hung continuous sash in vertical lines longer than 200 feet and sloping lines longer than 100 feet to have spirals and counterweights with slides and automatic safety stops.

Alternate

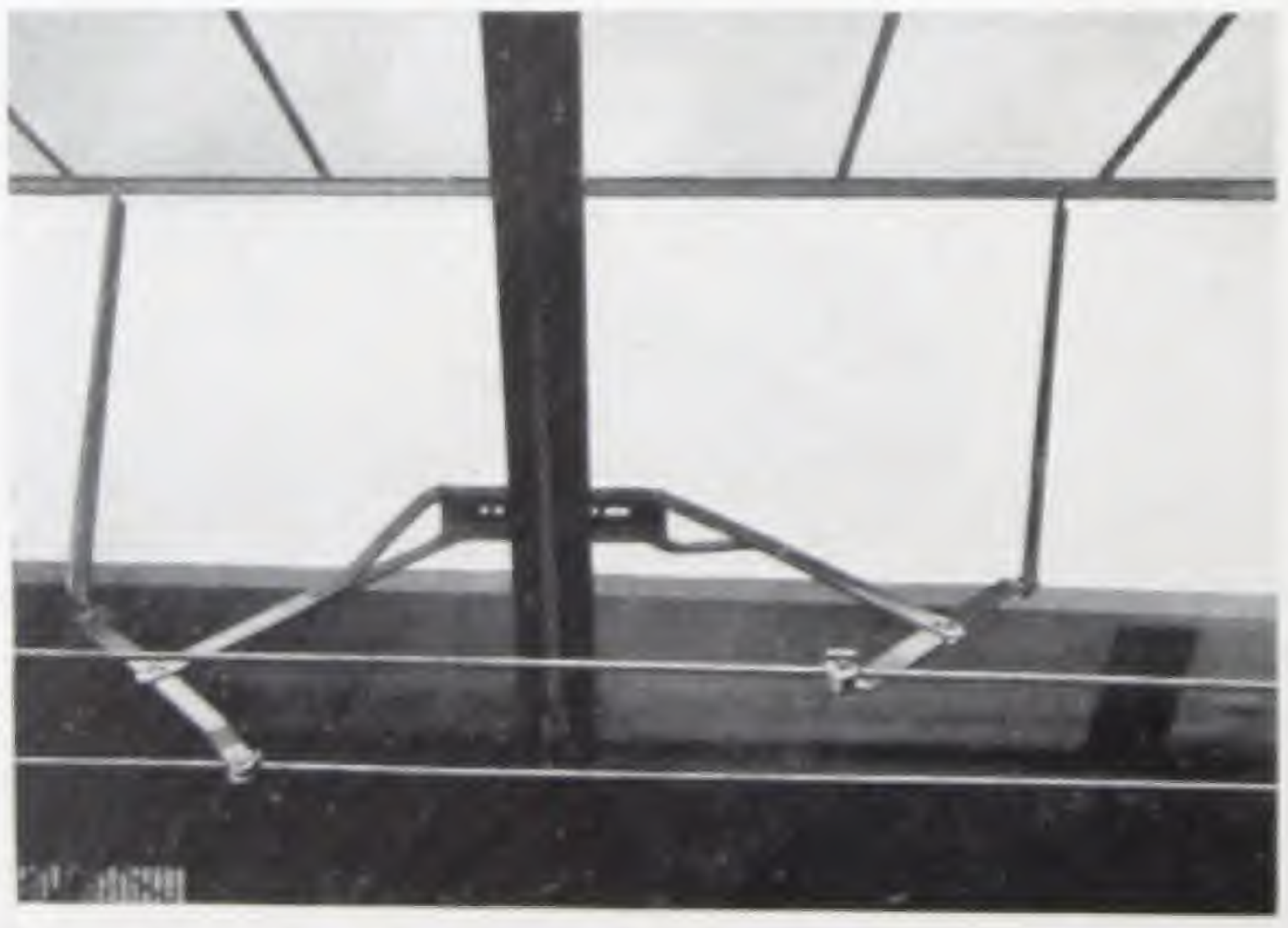
When it is desired to receive alternate proposals for other devices, specify that all parts of the substitute services shall be submitted for comparison of design, mechanical construction, and material. Require a physical test to determine comparative power transmitted, strength and durability, friction losses, ease of operation, and maximum width of sash.

Pond Operating Device in Pond Truss Roof in David Lupton's Sons Co. factory. The sash rods are connected alternately to the upper and lower transmission rods, and thrust alternately to left and right, the thrust becoming practically direct when sash is fully open.



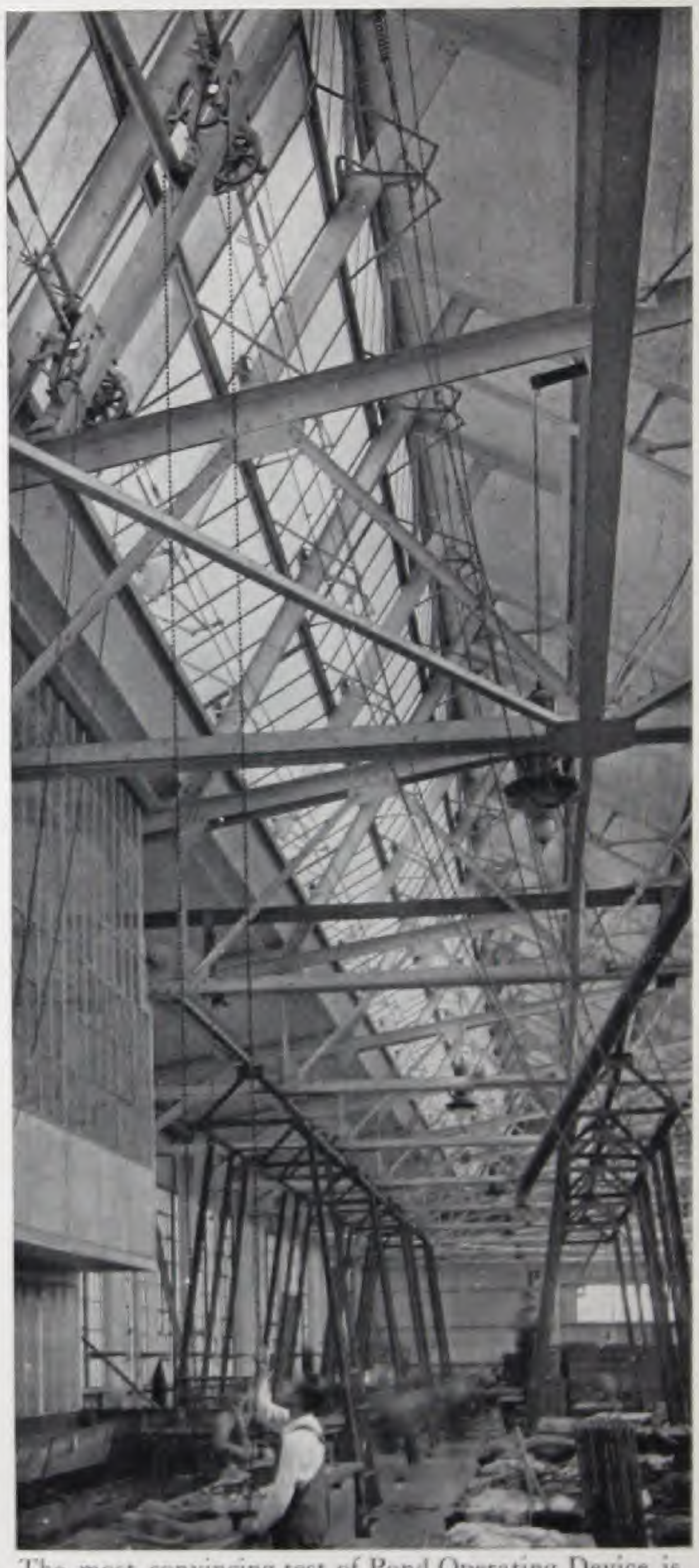
Tension rods and compound levers; sash closed. To open: upper tension rod moves to right, lower rod to left

Sash Partly Open. Note increasingly direct thrust as sash is raised

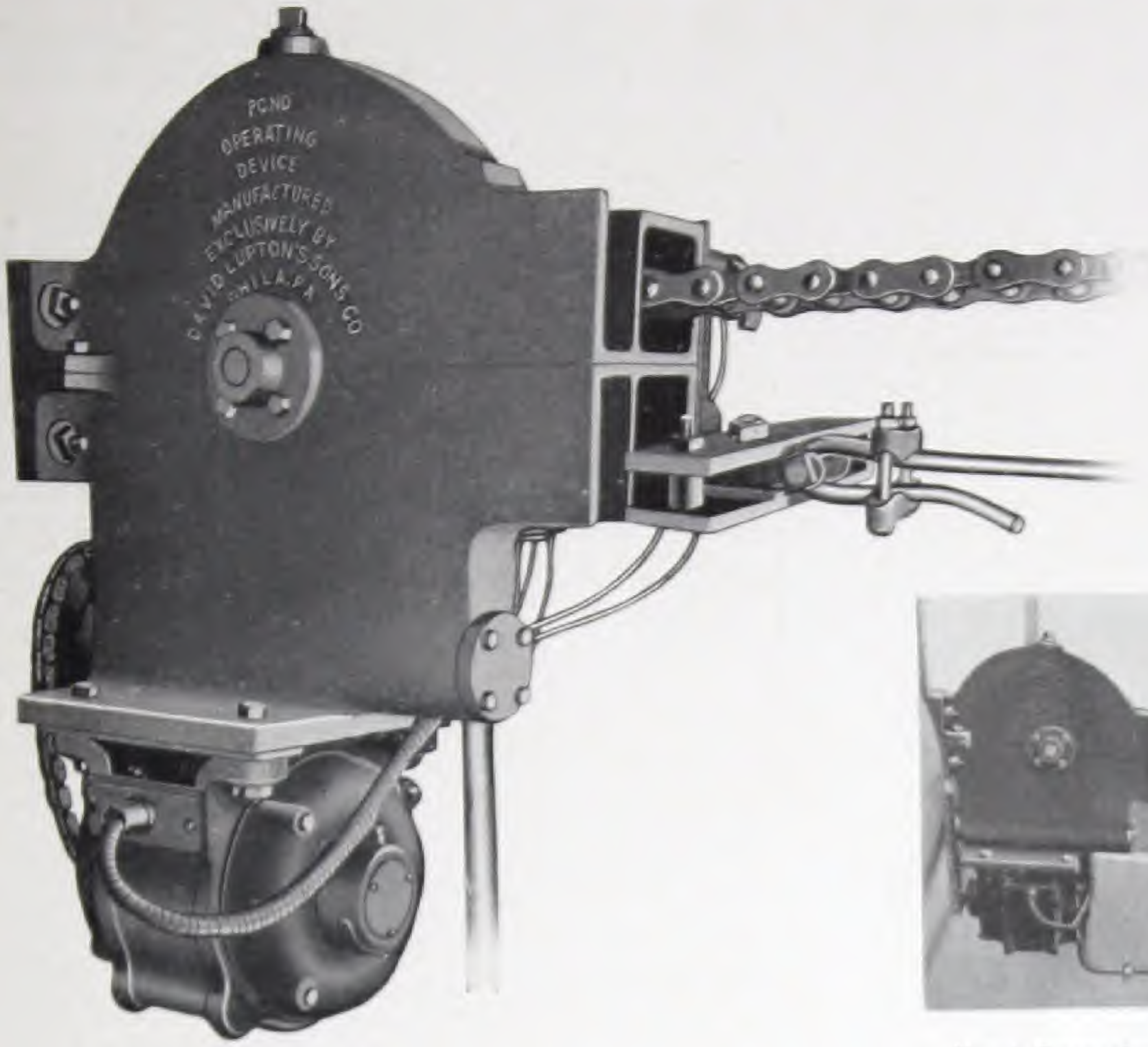


Sash Fully Open. By using compound levers to convert lengthwise into lateral motion, stationary guides and their attendant friction are avoided

Pond Operating Device, X-Arm
For the control of Pivoted Ventilators in Steel Sash



The most convincing test of Pond Operating Device is a pull on the hand chain



Pond Operating Device, Motor Driven. A cutout attached to the case opens the circuit when the desired limit of motion of the tension rods has been reached.

Pond Operating Device, Motor Driven, attached to line of sash.

Pond Operating Device, Motor Driven

A building which is well ventilated on paper but not in practice is a costly failure.

Large floor areas where many skilled workers are employed, or where heat or fumes are produced, are best ventilated by centering the control of the sash at the fewest possible points. The worst possible arrangement is to have hundreds of small sash units in complete control of the individuals nearest them, since these individuals are least interested in supplying fresh air to those farther from the windows. The ideal arrangement, under certain conditions, would be to have one responsible foreman, by pressing a series of buttons at his desk, open or close both roof and side wall sash for an entire floor.

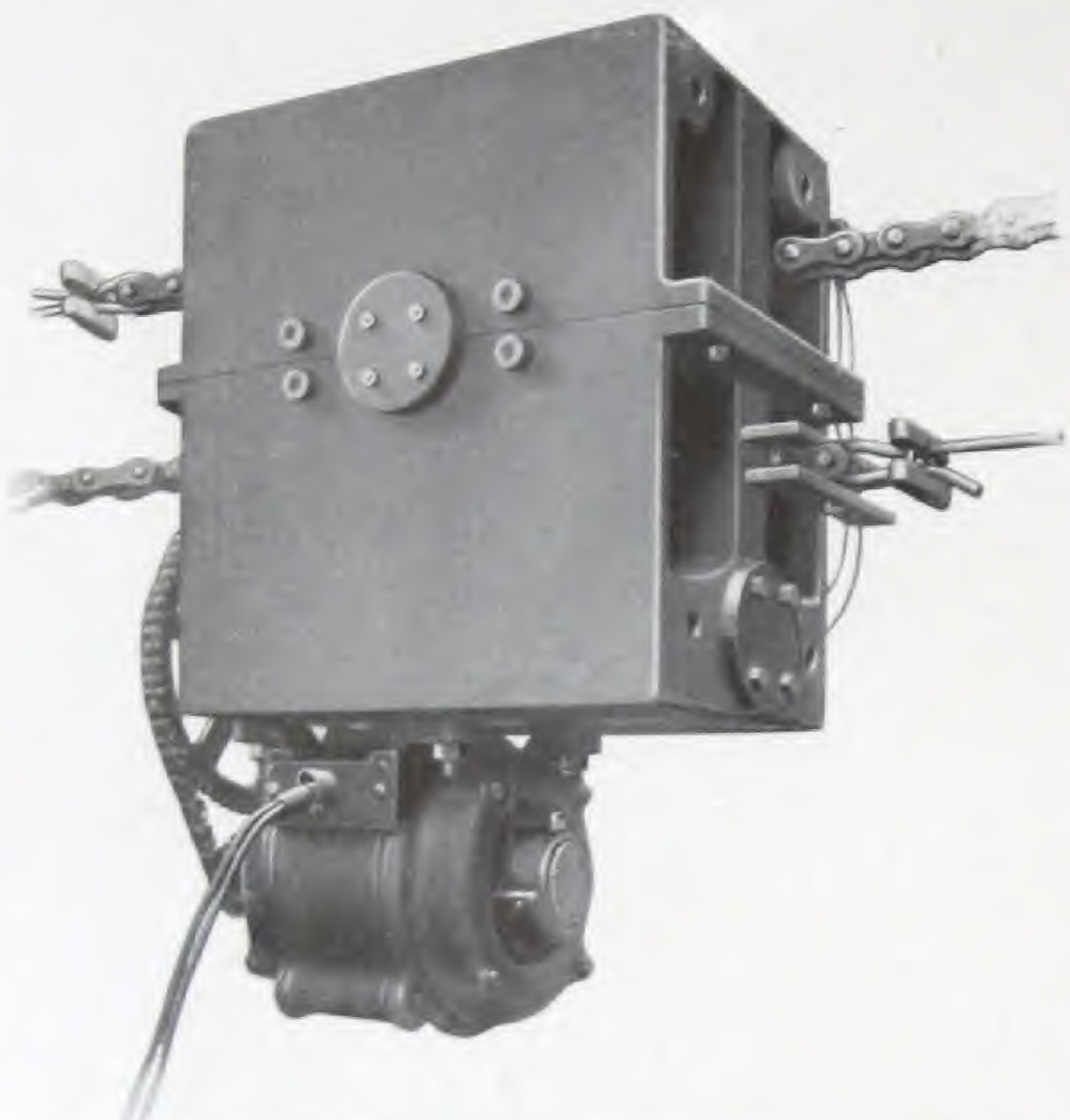
The purpose of the motor-driven type of Pond Operating Device is to enable large areas of Pond Continuous Sash to be controlled quickly and without physical effort. These may take the form of continuous runs, sometimes hundreds of feet long, with a motor for each run, or of shorter parallel runs connected in groups. The principle may be applied both in roofs and in side walls, and the operating stations may be located wherever desired.

Thus, in the Pond Trusses and A-frames of the Dayton-Wright Airplane Co. building (see chapter on Pond Truss, page 31), the twelve lines of 6-foot Pond Continuous Sash are divided back of the offices into two "runs" each, of approximately 400 and 600 feet respectively. Each run is operated by one motor; hence the entire floor area of approximately 266,000 sq. ft. is ventilated from but six operating stations, four motors to a station. By walking across the building once, one person can reach every station.

Another notable application of this principle of centralized control is the B. F. Goodrich Building No. 40 (see opposite page). This building was designed for making rubber footwear; it is six stories high, 100 feet wide, in two wings totaling 500 feet long. The lower floors are devoted to the primary operations of rubber manufacture and to storage demanding

much space but little labor. The top floor, however, is given wholly to assembling the uppers, welts and soles ready for vulcanizing. About 1000 operatives are thus employed in an area of 1¼ acres; and by doing the work under ideal conditions of light and fresh air, a highly intensive rate of production is maintained.

The roof is of sawtooth type, and uniform escape of stale air is ensured by connecting all the operated lines of roof sash in each wing,



Type T-2 Power, by which one motor operates two sets of tension rods. Used with long lines of sash to divide the load on the rods.

and controlling them simultaneously by a single electric motor. Entry of fresh air to balance the outflow is ensured in any weather by lines of Pond Continuous Sash over the Lupton Counterbalanced Sash in the side walls.

An application to side walls is seen in the Bunt'ng Brass & Bronze Co foundry (see illustration, page 28, and others in the chapter on the Pond Truss). Each side of the building contains four lines of Pond Continuous Sash, each 185 feet long. For rapid operation the two lower lines are connected and operated by one motor, and the two upper lines by another motor. Of the six lines of roof sash, the top line on each side is operated by motor and the other two by hand chains.

In the Ford Motor Co. Power House (see chapter on Pond Continuous Sash) the space between pilasters in the boiler room is filled with short lengths of Pond Continuous Sash in groups, each group controlled by one electric motor. Motors are used also to operate small sections of Pond Continuous Sash connected in lines over the bunkers, also continuous lines of the same sash in the roof over the boilers.

It will be noted that in all the foregoing applications one of two purposes obtains:

1. To centralize and make easy the control of sash in buildings of unusual size, where the opening of short lengths of sash by hand would take too long and probably be neglected;

2. To operate many sash quickly, as in a large foundry in winter, when it is desired to open them for a few minutes only, to get rid of the smoke without unnecessary loss of heat.

Both of these results are increasingly vital in modern industrial plants; both are perfectly accomplished by the Pond Operating Device, Motor Driven.

Details

The motor drives through compound ball bearing worm gears cut from solid steel and immersed in oil. An automatic cutout attached to the sprocket chain limits the movement of the sash in each direct'on without strain on the operating device. It is arranged to open the circuit quickly to minimize arcing, although the chain itself moves slowly. The sash may be left at any degree of opening.

These motors operate on A. C. current, 220 volts, 60 cycles, 3-phase, and are especially wound for high starting torque. They are furnished from stock. A. C. motors of voltage higher than 220, and D. C. motors, are less satisfactory on account of the danger of arcing at the automatic cutout. Motors with other than our regular winding require six to nine months to deliver, and we advise against their use.

When our regular equipment is used it is guaranteed against defect of design, material or workmanship for three years. This guarantee is conditional strictly on the wiring being done exactly according to our specifications.

We should be consulted before specifying size of motors.

See Specification, page 30.

B. F. Goodrich Co. Building No. 40, Akron, Ohio

Osborn Engineering Co.
Consulting Engineers

Mr. A. P. Lohman
Mgr. Engineering Dept.

This building is devoted to the manufacture of rubber footwear, which is assembled on the top floor.
The wing shown is 100 ft. wide, with 14 lines of sawtooth in the roof. All the operated lines of Pond Continuous Sash are controlled simultaneously by one electric motor, giving a uniform outflow of stale air.
In the side walls, under the restaurant gallery, lines of Pond Continuous Sash over the Lupton Counterbalanced Sash afford an equally uniform inflow.
In the other wing three lines of roof sash each 140 feet long are similarly controlled. See sketch diagrams below.

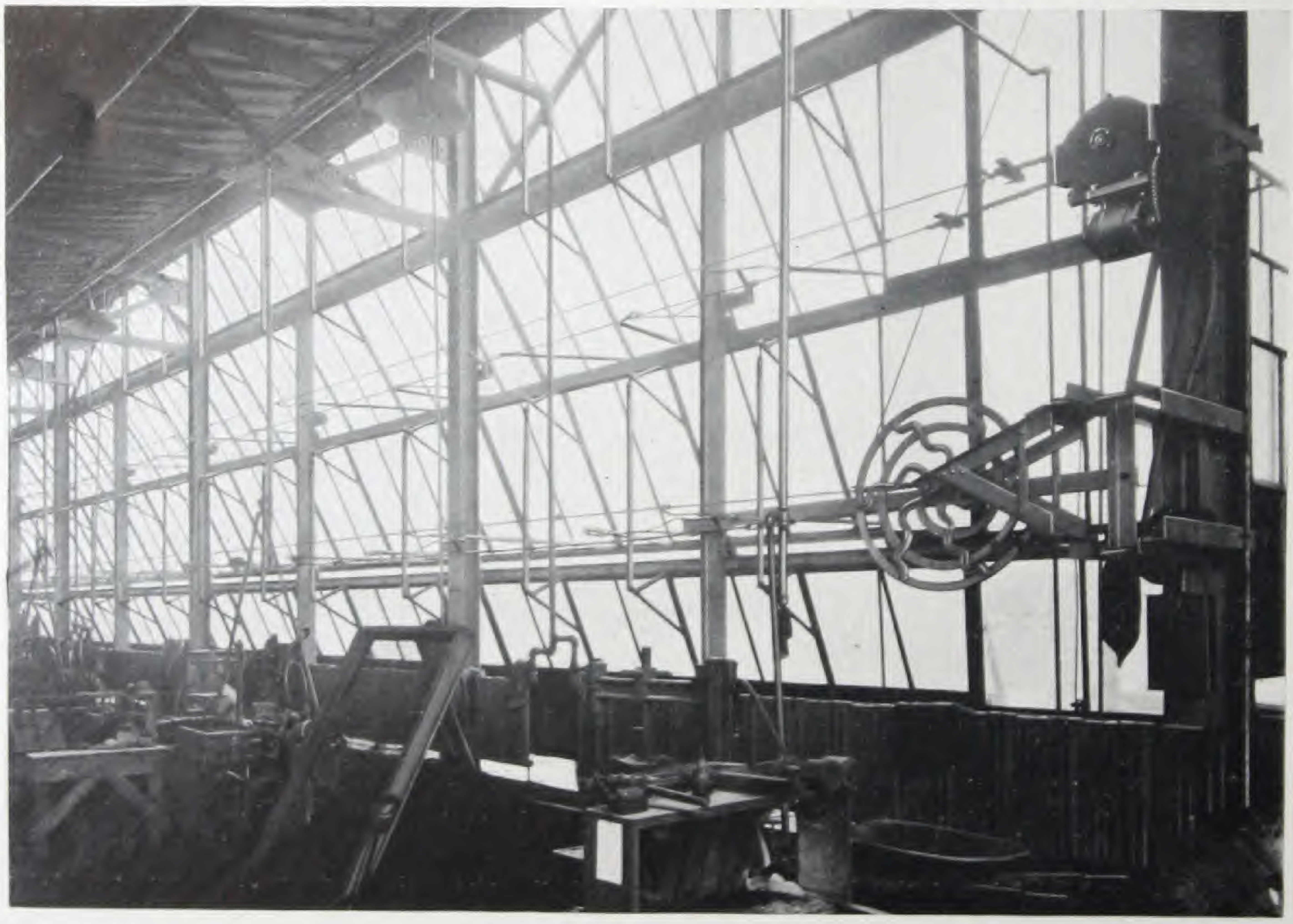
SPECIFICATION

Specify Pond Operating Device, Motor Driven, with worm gearing in oil-tight case; worm to be cut from solid steel, teeth of worm wheel cut from solid bronze, ball bearings used on worm shaft.

Motors to be for alternating current, 220 volts, 60 cycles, 3-phase, and specially wound for high-starting torque. Automatic cutout to be attached to gear case. Electrical contractor to do all wiring, also to furnish and erect double-throw switches, all in accordance with the standard specifications for motor-driven Pond Operating Device.

The owner will furnish alternating current, 220 volts, 60 cycles, 3-phase (installing transformer when necessary).

Pond Operating Device, Motor Driven, Type T-2, operating lines of Pond Continuous Sash in a Pond A-frame. One motor controls two sets of tension rods.



Pond Operating Device, Motor Driven, operating Pond Continuous Sash in side wall of Bunting Brass & Bronze Co. foundry. The two lower lines of sash are connected by vertical arms, operated by one motor, and balanced by a spiral and counterweight. The two upper lines are similarly connected and operated.

POND TRUSS ROOF DESIGN

(Patented by Clarke P. Pond)

The Pond Truss roof was originally designed to secure better ventilation and lighting in large foundries and forge shops than was possible with other forms of roof. It is now widely used also for machine shops and other manufacturing buildings where abundant fresh air and light are desired over wide areas.

With the steady growth of industrial units, the tendency toward greater floor areas and more intensive production has gone beyond the ability of conventional building types to secure physical comfort and reasonable output per man. In the effort to reduce overhead the human factor has been partially overlooked.

Careful study of air movements in these buildings convinced us that, even with the best possible sash, their design was basically wrong in the following respects:

1. The roof outlets were too small. Hence the upper space, and eventually the entire building, filled with smoke and fumes which could not escape.

2. The buildings were made high to "get the heat off the floor." This worked until the upper part of the building became filled, but only till then.

3. The smoke and gases which could not escape became cool from contact with roof and walls, and descended, fouling the air at the floor level. This was aggravated by the pivoted type of sash generally used, which allowed cross winds to enter the monitor and blow part of the smoke down to the floor.

4. The roof outlets were too near the central axis to be available to heat currents rising in the side bays. The lateral travel required of these heat streams caused them to mix with the surrounding air.

5. The monitor openings were as badly placed and insufficient for lighting as for ventilation. The whole building, except sometimes the side bays, was too dark.

The result of these defects was to destroy the ventilating efficiency—and largely the lighting also—of all but very narrow buildings. Failure to realize this fact has led to the construction of foundries hundreds of feet wide, of which no portion except that close to the walls receives satisfactory air or light.

For the remedy three things were necessary:

1. A new type of sash that would check down draft, and would be fully weather protecting and controllable in long lines, so that thousands of square feet could be opened or closed at once. Pond Continuous Sash, already in service in sawtooth roofs and conventional monitors, fulfilled these requirements. When properly operated, it afforded an abundant outlet in all weathers.

2. A roof so formed as to carry all heat currents by the shortest route to large outlets and light the whole interior with equal effectiveness.

3. Ventilating inlets in the side walls as ample and dependable as the outlets.

The Pond Truss roof was the answer.

Its wide inverted slope carries all smoke and heat directly to the large outlets. These outlets, hung with from two to five lines of Pond Continuous Sash, are so ample that no production of heat or smoke below can overtax them. The sloping lines of sash below the vertical lines afford an easy flow to heat currents rising in the side bays, so that they are carried naturally and easily up to the outlets.

The side walls are filled preferably either with Lupton Counterbalanced Sash or with Pond Continuous Sash, the latter especially where the ventilating requirements are severe.

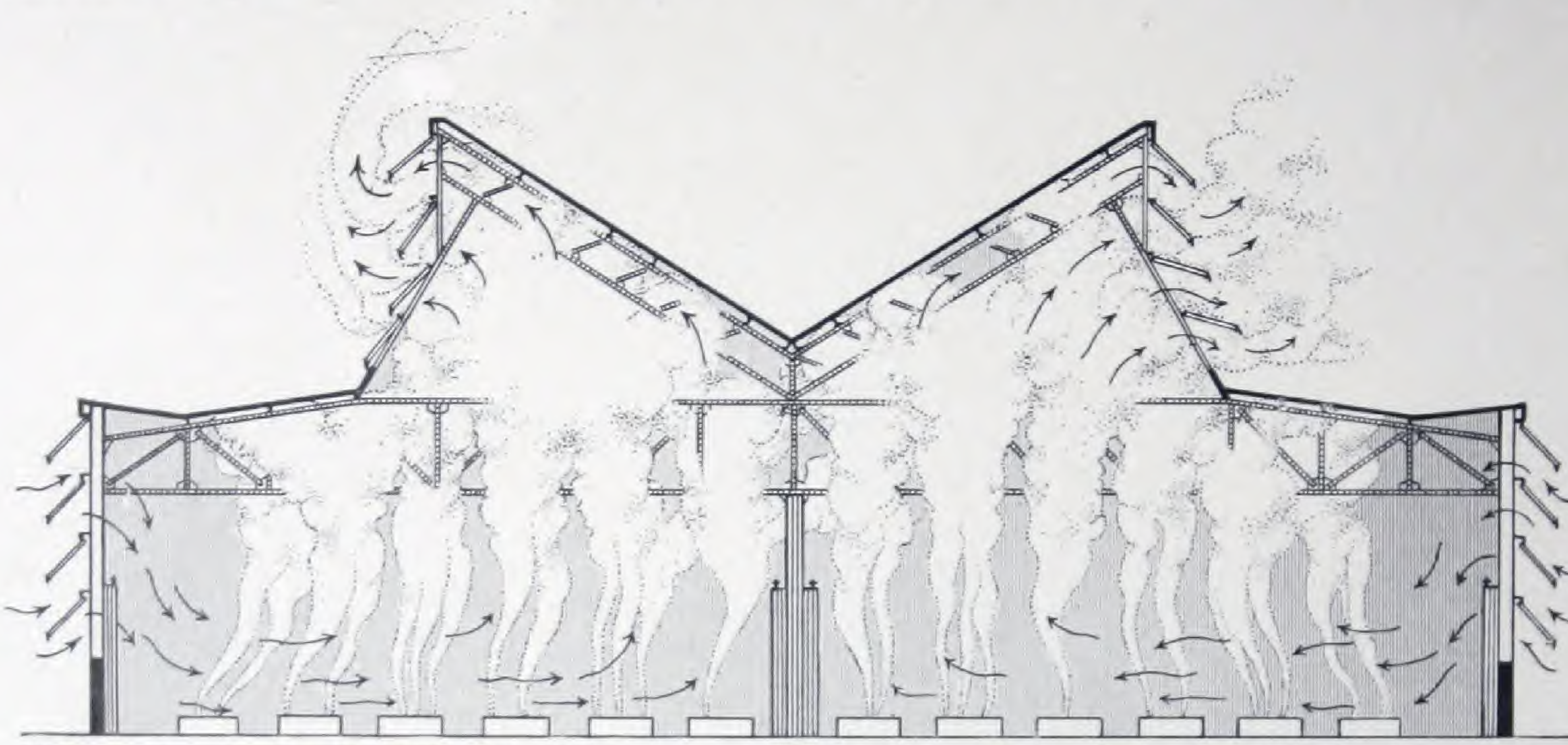
For effective ventilation the inlet areas must balance the outlets.

Where the ventilating needs are moderate, as in a factory building, Lupton Factory Sash may be used; but in that case the top line at least of ventilators should be mass-controlled by Pond Operating Device, to admit fresh air uniformly in winter over the heads of workers near the walls. This same principle—namely, of uniform distribution of the fresh-air supply—is carried out when Lupton Counterbalanced Sash are used, by a line of Pond Continuous Sash above the sliding sash.

The wide outlet lines of sash, with the reflection from the inverted roof, give abundant light to the central bays. The side walls are low, and are required to light only the side bays; hence there is not the unpleasant glare that follows entrance of direct sunlight through high walls filled with glass.

Perhaps the most fundamental reason for the success of the Pond Truss roof was the abandonment of the old "chimney theory" of ventilation. According to that theory a heat-producing building should be as high as possible. Uniform diffusion of the smoke and air was assumed, and rapid flow through small openings under the pressure due to temperature was also assumed. But the actual velocities were too low, and the practical result of the chimney theory was that the building had to get unbearably hot in order to ventilate.

The Pond Truss, on the contrary, is designed to let smoke and heat escape as they would outdoors. Each individual mold or furnace is the source of a heat current, which rises freely through the surrounding air to the roof, travels a short distance, and immediately escapes. The roof is no higher than necessary for clearances and cranes, hence the smoke gets away before it has time to diffuse. No reliance is placed on any rise in temperature of the mass of air as a whole, and the general result is that of a free upward movement of many heat currents, with abundant fresh air entering from the sides to take their place.



Cross section of typical Pond Truss foundry, showing movement of air and heat currents. Smoke will escape against a light cross wind if the lower lines of roof sash are wholly or partly closed.

As the illustrations show, the Pond Truss design is not stereotyped. A steel foundry, a grey iron foundry, a forge shop and a brass foundry, even of similar sizes, have different ventilating requirements and require different roof proportions. Variations in floor width and in size of work handled introduce still further modifications. The line sectional drawings in the inside cover show examples, some of which are illustrated by halftones. Among the most interesting is that of the Bunting Brass & Bronze Company foundry, where two rows of large coke-fired furnaces are placed one on each side of a 20-foot center aisle occupied by twenty furnace tenders. The furnaces are too close together to permit enough fresh air to get past them; hence fresh air is supplied to the aisle by a ventilating

tunnel running the length of the aisle and fed by cross ducts from outside.

Depending on the character of the building, one Pond Truss will ventilate a floor up to from 125 to 250 feet wide. For greater widths two or more parallel Pond Trusses are used; but instead of placing them side by side with no means of admitting air between them, provision is made to introduce cold air through the low sections of the roof.

The best way of doing this is by introducing low-roofed "fresh-air bays" 40 feet wide between the bays directly flanking the Pond Trusses. A typical detail is shown in the inside front cover, but the exact proportions depend on the design and use of the building.

These "fresh-air bays" are used for flask or material storage, stock rooms, and the like. The offices for foremen and timekeepers, and the toilet rooms, may also be placed there, with inner roofs 8 feet high, and ventilating pipes carried up through the A-frames.

To insure further that the air currents shall flow in the desired direction, all heat-producing operations are located under the Pond Trusses.

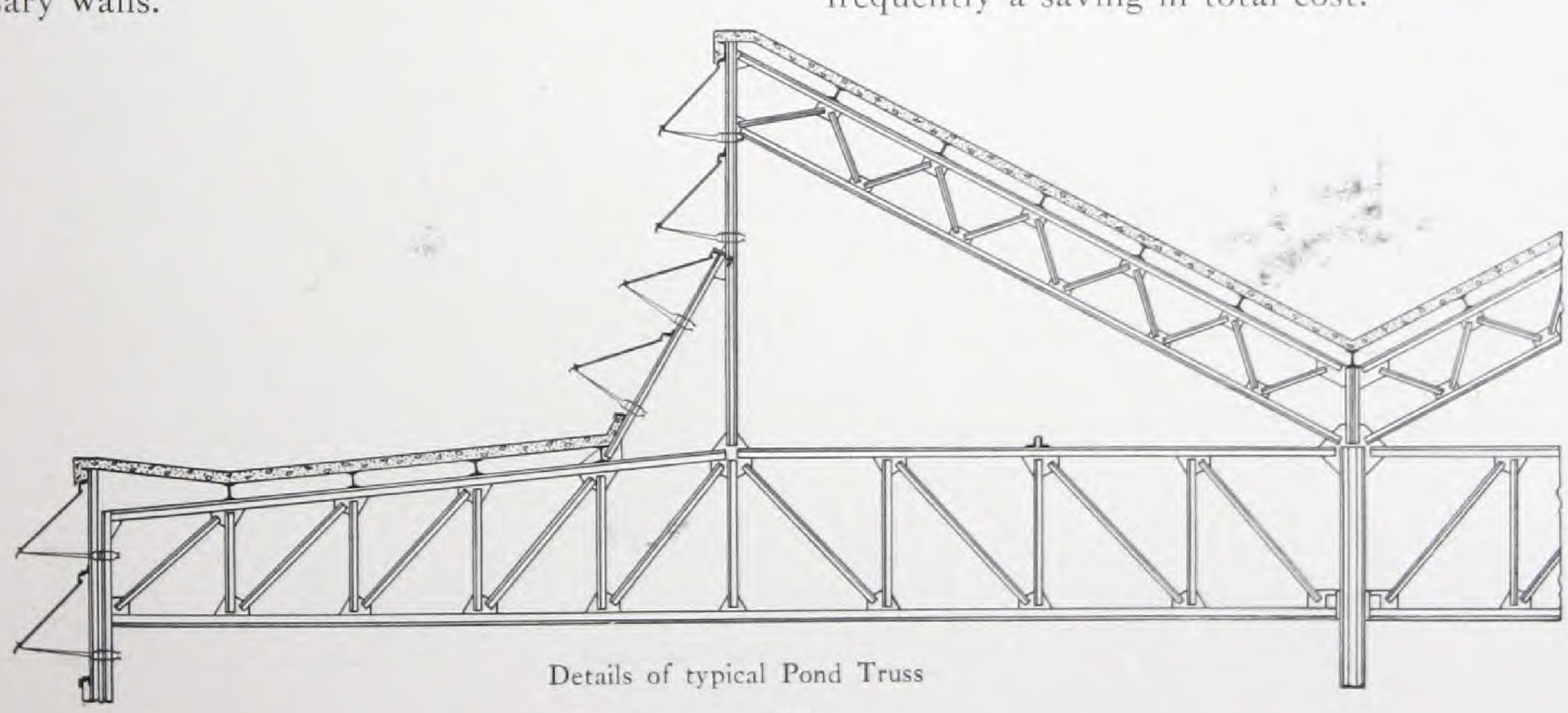
If desired, the A-frames may be placed directly on the roof, as shown in the front cover. In that case sufficient width must be allowed between Pond Trusses so that ingoing and outgoing air currents will not interfere.

By these means a foundry or other building can be made of indefinite width, with notable savings in construction cost and greater freedom in floor layout due to absence of unnecessary walls.

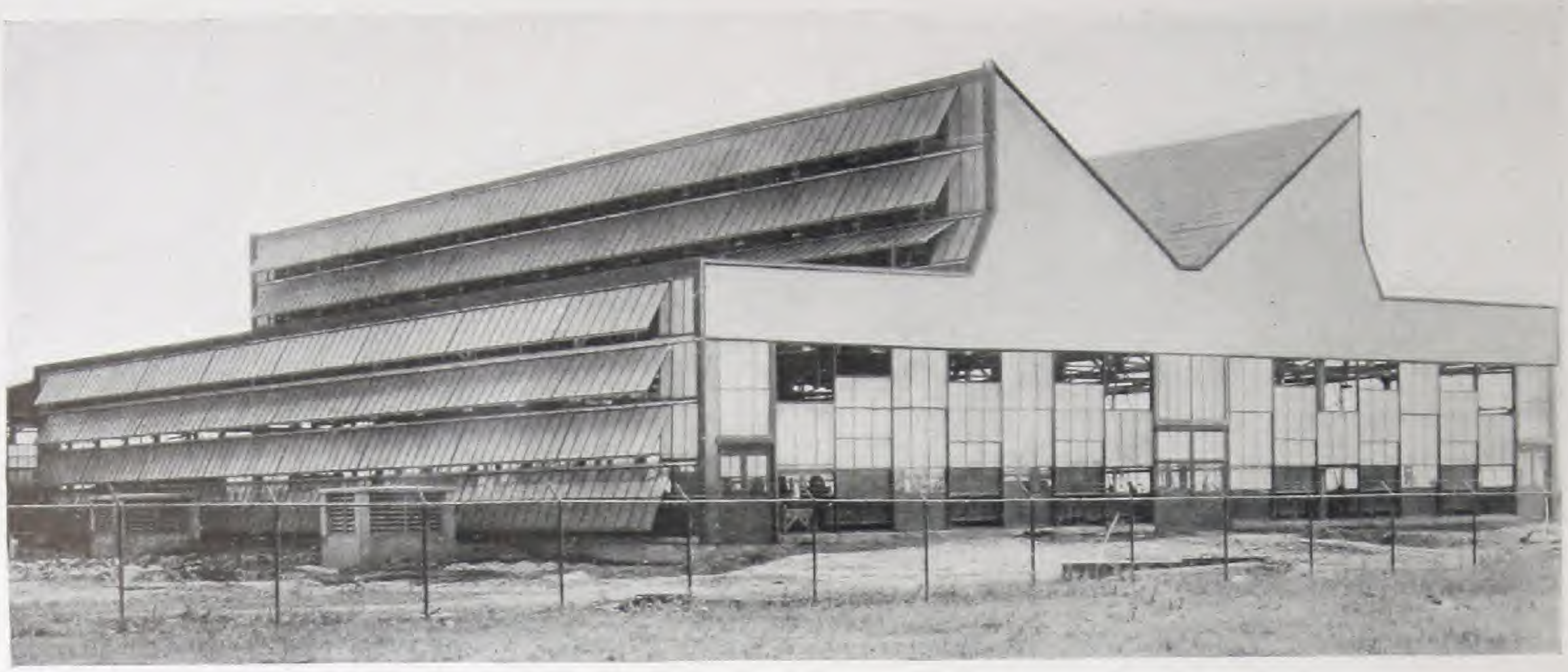
For machine shops and general manufacturing buildings the Pond Truss presents marked advantages. For wide buildings especially it is far superior to the sawtooth. A sawtooth-roofed building looks well-lighted when empty. But when it is filled with equipment the absence of cross-lighting gives every object a light side and a shadow side; and when facing the sash the contrast between the glass above and the dark sides of the objects below makes it impossible to see fine work clearly. This fault is entirely avoided with the Pond Truss. When placed as usual, running north and south, the planes of the Pond Truss roof serve not only to carry heat currents to the outlets, but to reflect downward the morning and evening rays which are wasted with the sawtooth. In winter this reduces or eliminates the need of artificial light.

In ventilation the superiority of the Pond Truss is even more marked. The sawtooth, owing to the uniform height of its openings, does not tend to draw fresh air down; and the upflow due to temperature is not sufficient to draw fresh air from the sides of a wide building to the centre, even if the inlet area were sufficient to match the outlets, which is seldom the case.

The structural cost of the Pond Truss roof, for machine shops and general manufacturing buildings, is about equal to that of a sawtooth of like glass area. Owing, however, to the better distribution of light, it is possible to get better lighting with less glass, so that there is frequently a saving in total cost.



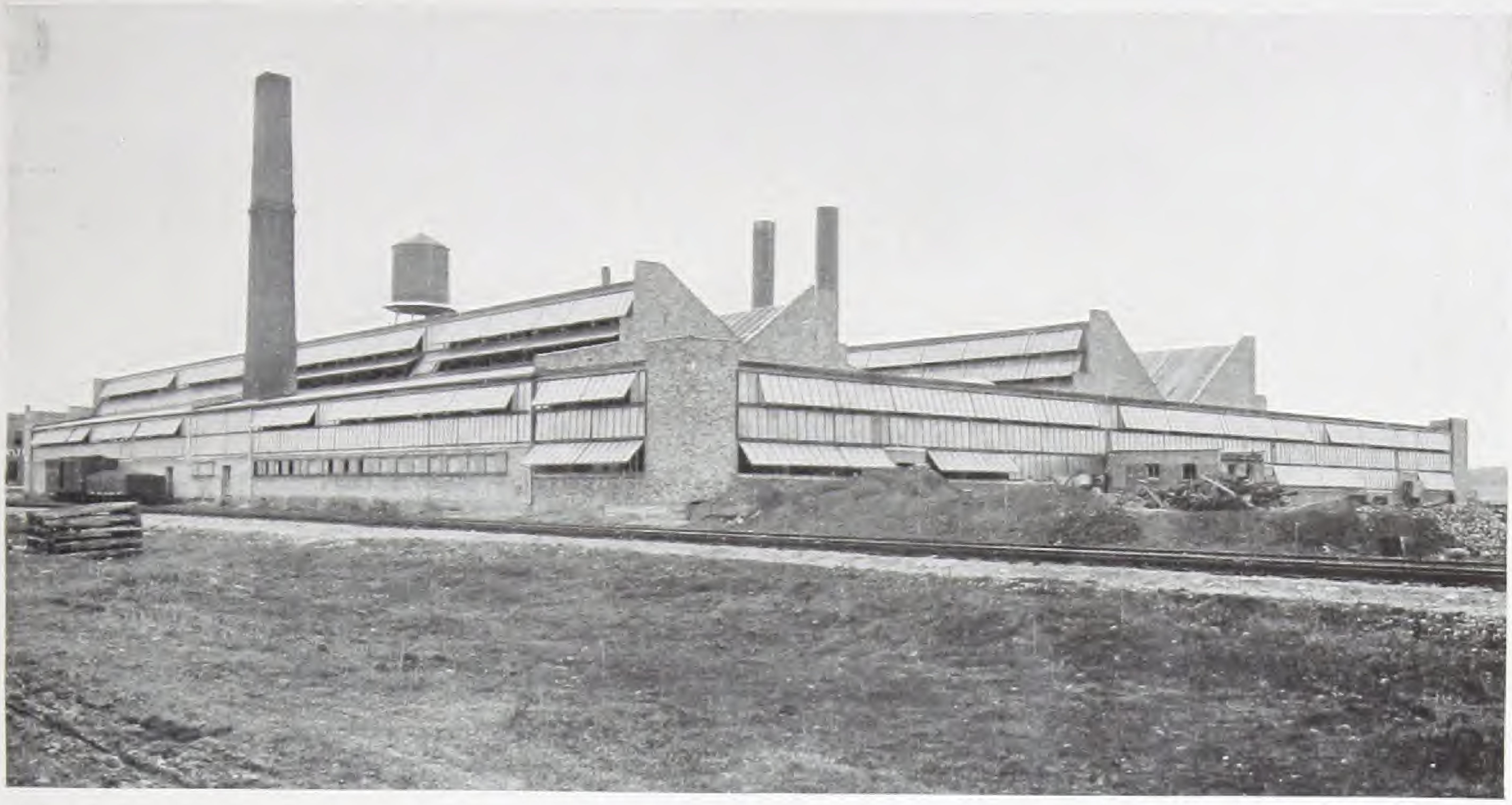
Details of typical Pond Truss



Messrs. Mills, Rhines, Bellman & Nordhoff
Architects
H. M. Lane Co., Consulting Engineers

Bunting Brass & Bronze Co.
Toledo, Ohio

This brass foundry is 115 x 195 feet, with 32 furnaces spaced 10 feet on centres in two rows with a 20-foot aisle for the furnace tenders. As the furnaces are too close to permit enough air to flow between them to the aisle, additional air is supplied through floor gratings from a tunnel under the aisle, which is fed by cross tunnels from four side intakes (see upper view). The upward flow of heat from the furnaces, escaping by the Pond Truss outlets, creates a strong inflow which keeps the aisle and molding floors clear of smoke at all times. See cross section and floor plan in inside back cover. Pond Continuous Sash, using Pond Operating Device, Motor Driven, used in roof and side walls. Lupton Counterbalanced Sash used in end walls. See page 30 for detail of operation of the sash in side walls.



Frank D. Chase, Inc.
Industrial Engineers

Moline Malleable Iron Co.
St. Charles, Ill.

The Pond Truss at the right is over the main molding bay, and the one at the left is over the annealing and finishing room. In the foreground, extending to the right, the transverse cleaning building is shown. Pond Continuous Sash, 6 feet high, controlled by Pond Operating Device, is used in all openings in Pond Truss and side walls.

The Arnold Co.
Engineers and Contractors

Nash Motors Company
Kenosha, Wis.

This foundry is 120 feet wide x 620 feet long. The work is small but accurate, demanding abundant light. Roof is a Pond Truss, with Pond Continuous Sash motor-operated in long lines by Pond Operating Device. Lupton Pivoted Factory Sash used in side walls.

Pond Truss and Pond Sash over continuous glass furnace. Lupton Steel Sash in side walls and Pond Sash in sawtooth lines of low roof.

DeVore, McGormley Company Engineers

Owens Bottle Machine Co.
Toledo, Ohio

Frank D. Chase, Inc.
Industrial Engineers

Consolidated Press Company
Hastings, Mich.

Interior of foundry. Roof is a Pond Truss. Pond Continuous Sash, hand operated, used in both roof and outer walls. Core oven and cupola are at left, against wall dividing foundry from material storage building. Lupton Counter-balanced Sash in this wall admits fresh air to foundry. See also page 14.

Mr. Conrad F. Neff
Architect

National Pneumatic Co.
Rahway, N. J.

The roof of this machine shop has two parallel Pond Trusses, using Pond Continuous Sash, hand-operated. A Pond A-Frame between the Pond Trusses admits light and air to the central portion of the floor. Lupton Pivoted Factory sash used in side and end walls. The view below is taken under one Pond Truss. See cross section in front cover.

Dayton-Wright Airplane Co.
Moraine, Ohio
Mr. O. Kressler
Maintenance Engineer

Messrs. Schenck & Williams
Architects

This building, now 270 feet wide by 1000 feet long, was designed for indefinite extension in both directions. Roof has two parallel Pond Trusses, with Pond A-Frames for inlet in the low roof space between them. Pond Continuous Sash used, motor-driven by Pond Operating Device in runs 400 and 600 feet long. Lupton Factory Sash in side and end walls. See detail views, page 39, and cross section in front cover.

Wm. Steele & Sons Co.
Engineers and Contractors

C. H. Wheeler Mfg. Co.
Philadelphia, Pa.

A well-lighted Pond Truss machine shop for heavy work. Pond Continuous Sash used in roof and upper walls; Lupton Factory Sash in lower walls.

Roof of Dayton-Wright Airplane Co. building, showing two Pond A-Frames and Pond Truss beyond. Pond Continuous Sash seen partly open.

View inside Dayton-Wright Airplane Co. building, looking across from east to west.

View inside Dayton-Wright Airplane Co. building, looking lengthwise down Pond Truss. Note the uniform lighting and the clean-cut simplicity of the reinforced concrete construction.

Inside Dayton-Wright Airplane Co. building, showing motors operating the roof sash. There are two such motors for each 1000-foot line of sash.

The Arnold Co.
Engineers and Contractors

The Pullman Co.
Pullman, Ill.

This forge shop is 240 feet wide and 508 feet long, with provision for further extension to its length. Roof is a Pond Truss, with Pond Continuous Sash, Motor Driven. Lupton Counterbalanced Sash used in side walls; Lupton Factory Sash in end walls.

Wm. Steele & Sons Co.
Engineers and Contractors

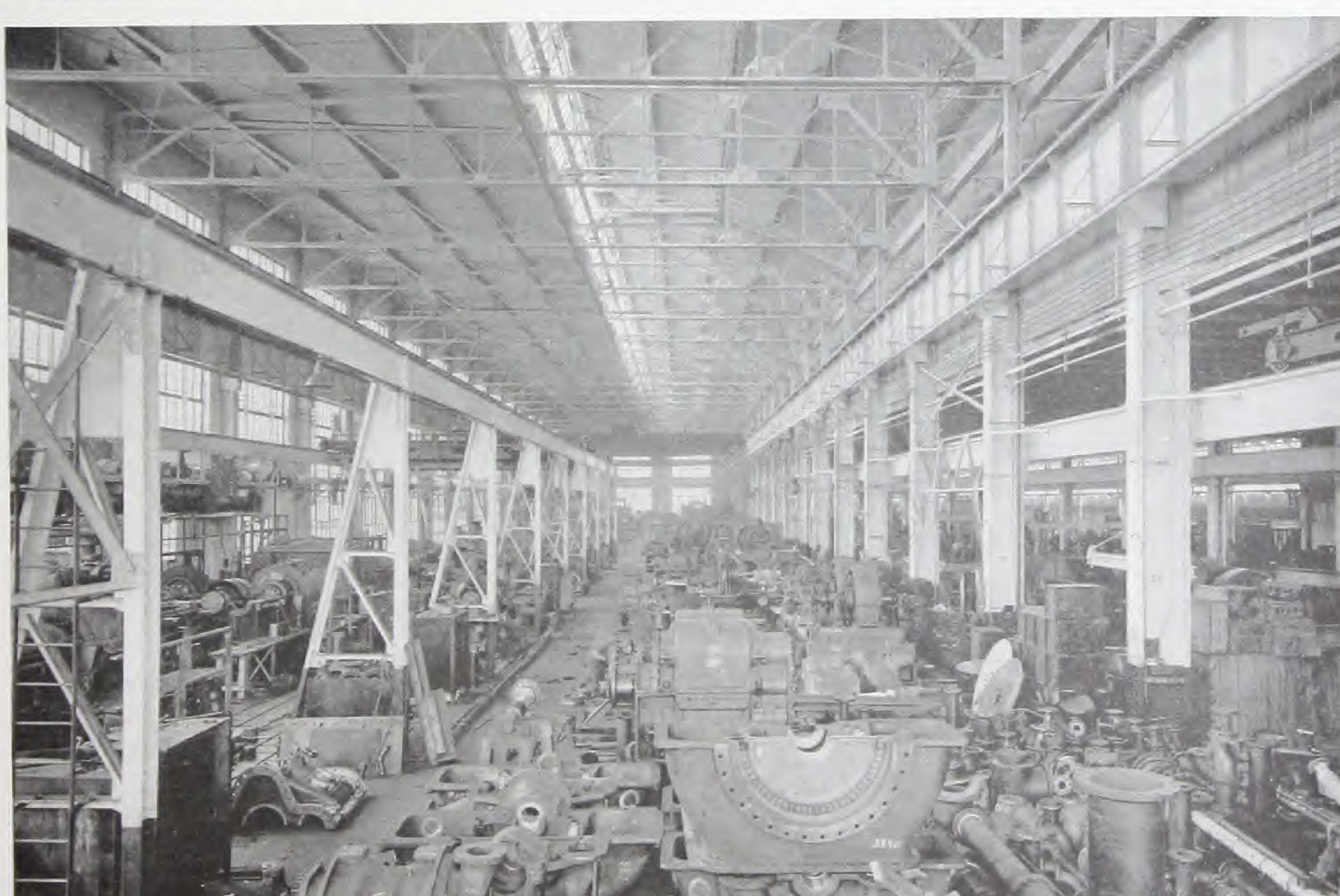
Savage Arms Corporation
Philadelphia

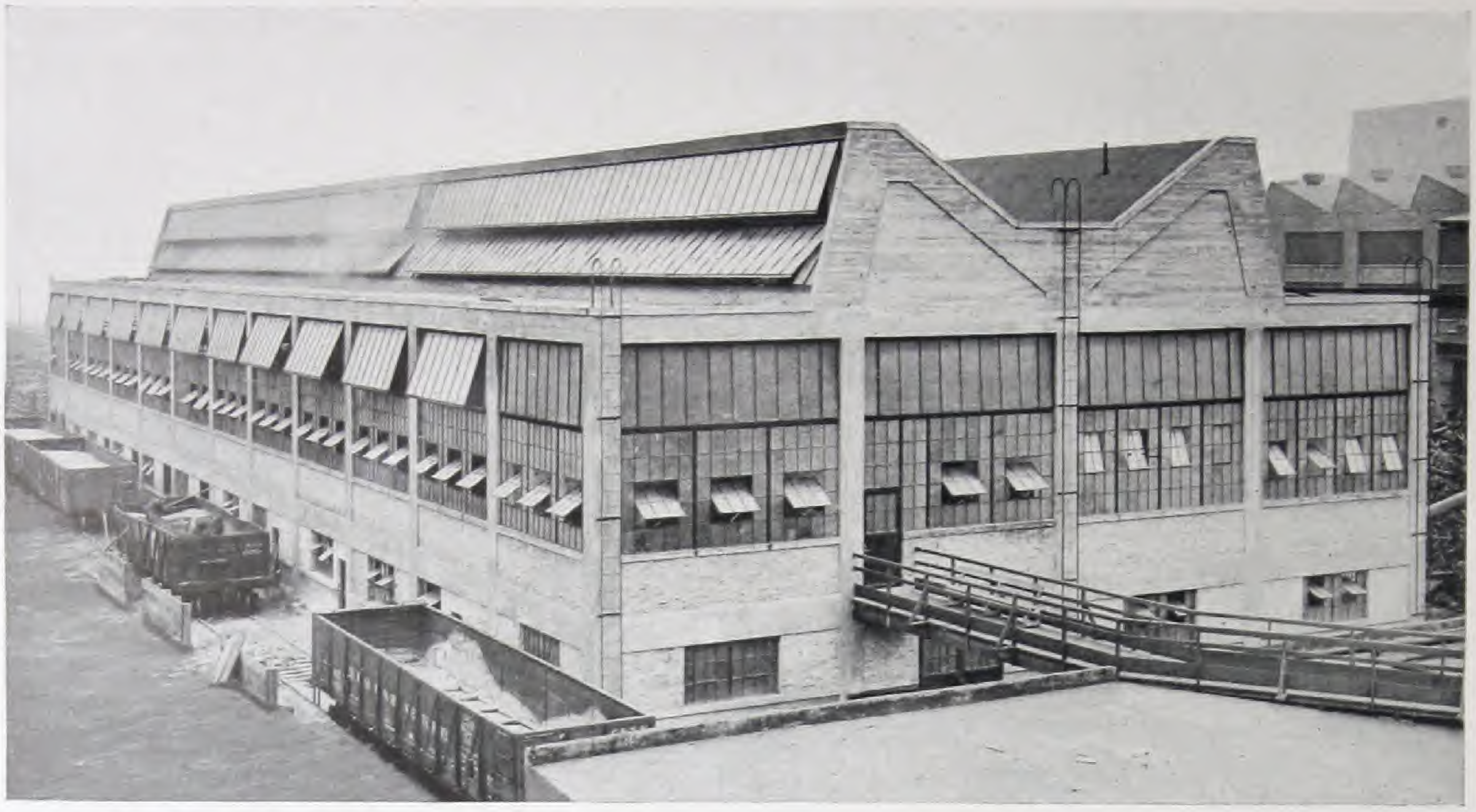
A notable example of machine shop lighting. Roof is a Pond Truss, with Pond Continuous Sash controlled by Pond Operating Device. Lupton Factory Sash in the side walls.

Messrs. Harris & Richards
Architects

General Electric Co.
Building No. 5, Erie, Pa.

Upper view looks south under gallery in east bay. Lower view is taken looking north in main (west) bay. Roof is a Pond Truss, with motor-controlled Pond Continuous Sash. Lupton Counterbalanced Sash used in side and end walls. Light is admitted above the roof of the east addition, but under the gallery, by three sloping lines of Pond Continuous Sash. See cross section of this building in inside front cover.





H. M. Lane Co.
Engineers

International Harvester Corp.
Milwaukee, Wis.

Core building. Ovens are arranged in rows under the high portion of the Pond Truss roof. Pond Continuous Sash used in roof, and in short lengths also in upper side walls, both controlled by Pond Operating Device. This ensures a uniformly-distributed inflow and outflow in all weathers. Lupton Factory Sash used in lower side walls.

Frank D. Chase, Inc.
Industrial Engineers

Saginaw Products Co.
Saginaw, Mich.

This foundry building measures 164 by 490 feet, and is flanked by separate storage, cleaning, core and pattern buildings. The main building has a Pond Truss roof, using motor-driven Pond Continuous Sash. Lupton Factory Sash are used in the side walls, with the top line of ventilators connected and operated in groups by Pond Operating Device.

OTHER LUPTON PRODUCTS

Lupton Pivoted Factory Sash
(Patented)

The exceptional quality of Lupton Factory Sash has long been recognized. Its accuracy and durability make it the most desirable sash of its type. Its strength and clean-cut appearance are due to the Lupton muntin joint, which is an exclusive feature.

Ventilators are operated by peg stays or by spring catch and chain, the latter being used for windows out of reach from the floor. When desired, ventilators may be operated in lines or groups by Pond Operating Device. See interior view of Saginaw Products Company foundry, page 42. The lower ventilators in the side walls of that foundry are operated by peg stays, the upper ventilators by Pond Operating Device.

Described fully in Catalogue No. 10-LSS.

Lupton Pivoted Factory Sash and Pond Continuous Sash used in garage. Upper line of ventilators controlled by Pond Operating Device, X-arm type. This garage has three modified Pond Trusses of the form shown.

Lupton Counterbalanced Sash
(Patented)

Has upper and lower sash hung from a single pair of pulleys so that they open or close together. Made "2-high" and "3-high," with ventilating area one-half and two-thirds the window area respectively. Gives most effective ventilation of any form of sliding sash.

Made in standard and special sizes, of heavy rolled members with corners solidly welded and ends of vertical muntins riveted. No horizontal muntins used. Details at head, meeting rails and still give effective weather protection with extreme simplicity of construction.

Especially valuable for wide factory buildings, since raising the lower sash opens the upper sash automatically.

Furnished also with rolled zinc weathering in jambs and mullions for office use.

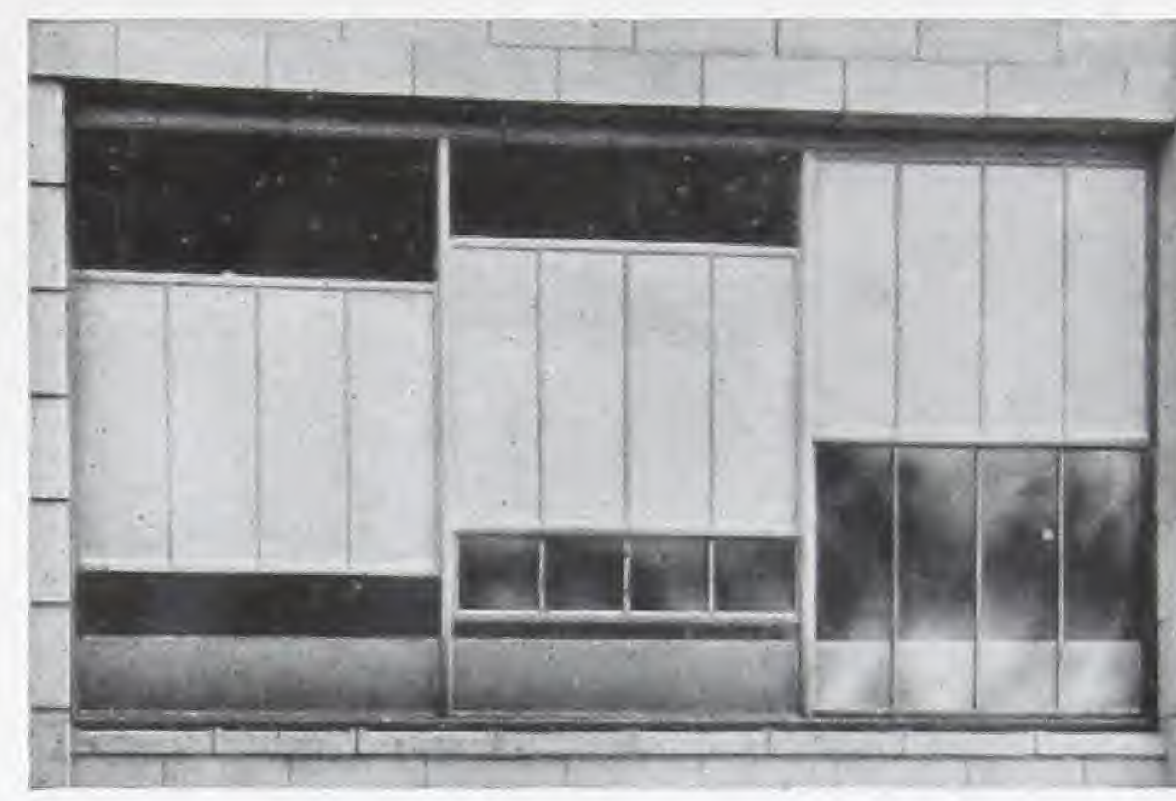
Described in Catalogue No. 10-LCB.

Lupton Counterweighted Sash
(Patented)

Similar to Lupton Counterbalanced Sash, but the sash separately hung. Used in the highest grade offices and office buildings.

Lupton Power House Sash
(Patented)

Has pivoted ventilators extending usually full width of sash and operated in groups by Pond Operating Device. Corners of sash are solidly welded, making them permanently corrosion-proof and therefore permanently rigid. Frames are specially formed, with imposts and mullions unusually heavy to carry out the massive architectural effect of a power house.



Lupton Counterbalanced Sash, 2-high, with wind shields. These are 4 lights wide, but 3 lights, each 18, 20, 22 or 24 inches wide, are more commonly used.

Catalogue on request.

Lupton Standard Steel Sash Partition and Doors

A newly designed, low-cost partition for general factory use. Jambs and mullions are structural steel sections. Panels are filled with steel plate, and with units of Lupton Factory Sash having channel frame members, instead of our standard angle section. Doors are built up of formed steel plate and special channel bars, and are solidly gas welded at the corners.

Partition units measure 5′ 11⅜″ or 6′ 1⅛″ centre to centre of mullions, according to whether 23″ x 40″ or 14″ x 20″ lights are used. Door units are 3′ 1¾″ centre to centre of mullions. Heights are approximately 8½′ and 10¼′, with filler plates to ceiling if needed.

Descriptive circular on request.

Lupton Standard Steel Sash Partition and Doors must not be confused with Lupton Special Partition and Lupton Welded Steel Tube Doors, described on page 44.

Lupton Special Partition

A specially designed, strictly interchangeable partition for office use. Jambs and mullions are formed steel plate. Units are filled with steel plate and glass lights set into frames of specially rolled channel section. Units are 8, 9, 10, 11 and 12 ft. high and 2′ $6\frac{7}{16}$″, 3′ $5\frac{9}{16}$″, and 6 ft. wide. All units 6 ft. wide and of similar height, with or without doors, are interchangeable.

Lupton Special Steel Partition and Doors in factory office Partition may stop with head rail, or may be extended to the ceiling by additional lights or steel filler plates as shown.

Mullions are bolted to floor, also to ceiling if required, and are readily removed and relocated or the units interchanged.

The massive appearance, simple lines and broad surfaces of Lupton Special Partition render it especially suited to fine office interiors.

Special catalogue on request.

Lupton Welded Steel Tube Doors

An especially strong and rigid type of door, used with Lupton Special Partition for offices, and in larger sizes for outside doors of factories, warehouses, etc.

Stiles are steel plate, formed into rectangular tubes with their seams closed by oxy-acetylene welding. Corners are mitred and oxy-acetylene welded. Lower portions are filled with panels of steel plate, held by formed and bolted Z-bar frames. Upper portions are filled with glass or a steel panel, or with wire netting, as required.

For offices and small exterior doors the standard sizes are 3, 4, 5 and 6 feet wide; 7, 8, 10 and 12 feet high. Doors may be placed double if desired.

For factories, etc., sizes are up to 9 x 16 feet for single doors; 18 by 16 feet for double doors; hinged or sliding, as desired.

Standard types of hardware are furnished.

Special catalogue on request.

Lupton Steel Skylight
(Patented)

A U-shaped rolled-steel bar which supports the glass flexibly on strands of specially saturated, permanently waterproof fibre. Especially valuable for buildings with much vibration.

Illustrated folder on request.

Lupton Steel Shelving

All Lupton Steel Shelving has the front edges of the shelves formed over a specially rolled channel bar re-enforcement, forming a practically one-piece construction for each shelf.

Bolted Type

The ends of the channel re-enforcements are bolted to the side uprights, thereby relieving the corners of the shelf from strain. This type is remarkable for its load-carrying capacity: a shelf 3 ft. wide by 18 in. deep will support a test load of 2000 lbs.

Bracket Adjustment Type

The ends of the channel re-enforcements rest on malleable iron brackets hooked into perforations in the uprights, much as the shelves of a bookcase are supported and adjusted. These brackets may be raised or lowered without disturbing the contents of adjacent shelves. The time required to adjust the empty shelf is approximately one minute. This type of shelf is especially valuable in a warehouse where the goods stored are liable to change, as it permits 100 per cent. of the available storage

Lupton Counterbalanced Sash used in school building. The balanced top and bottom openings ensure ventilation whenever the lower sash are opened.

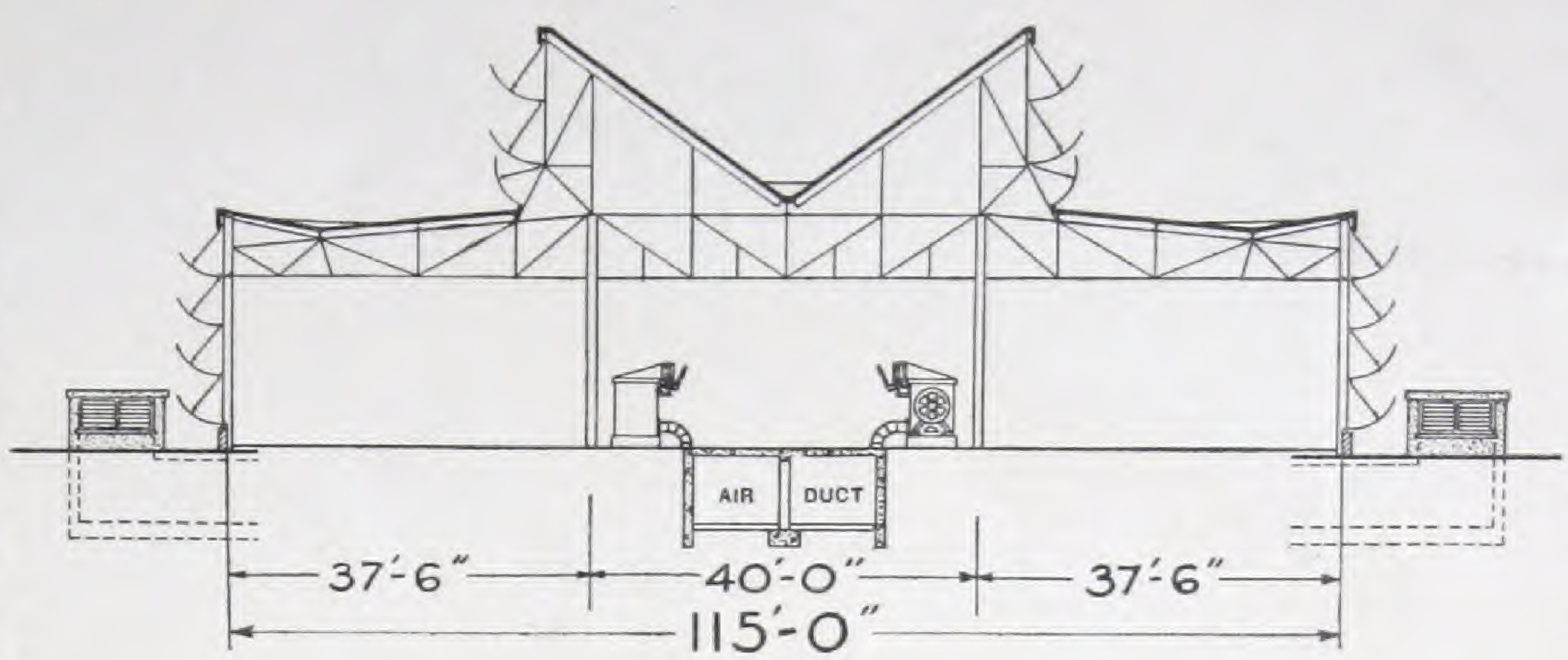
space to be constantly used with minimum expenditure of time for re-locating shelves.

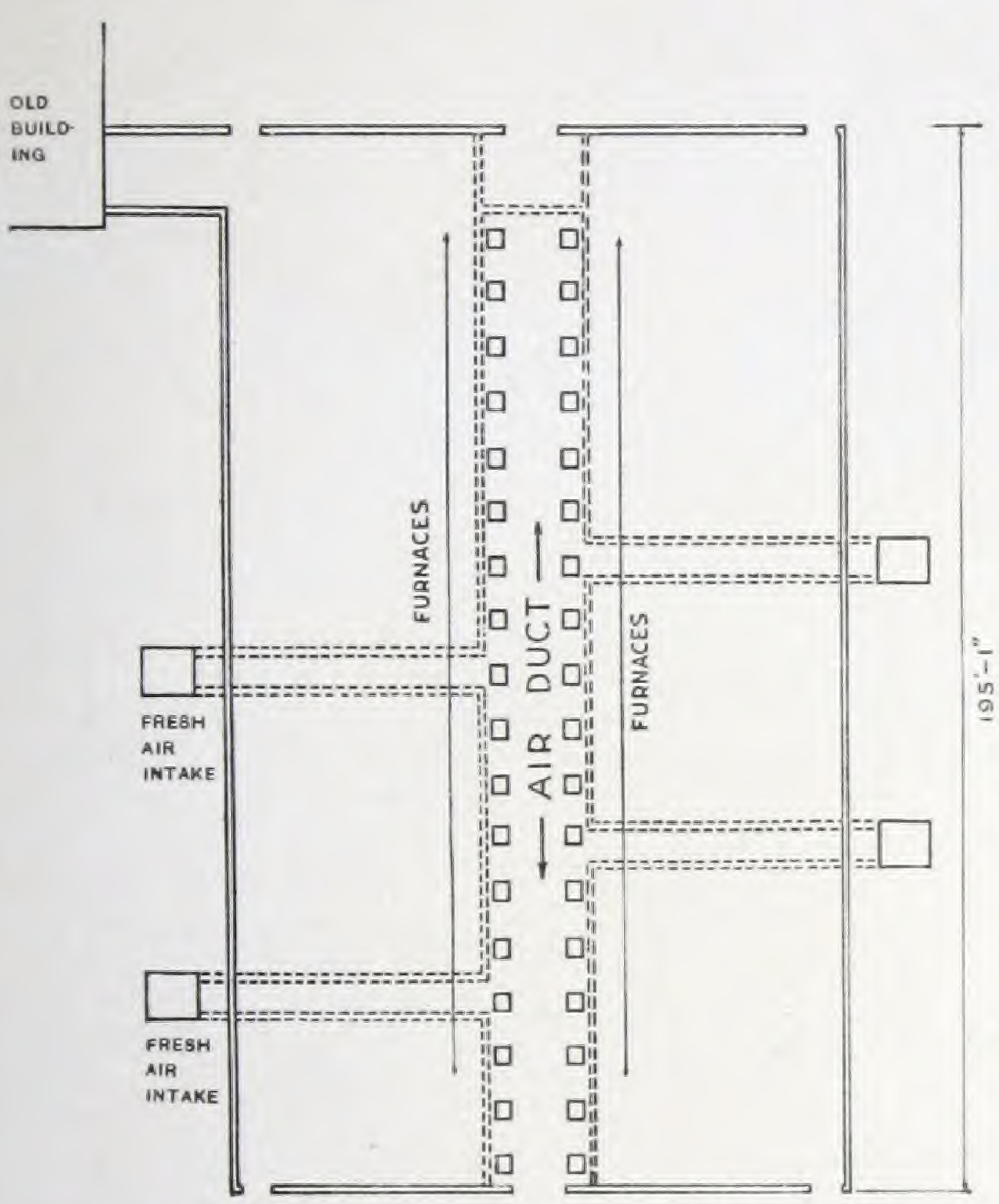
Both types of Lupton Shelving are made with closed sides and back, open back and closed sides, and open rack or skeleton form, as desired. The closed or bin type is made with bin fronts, compartment dividers and other usual accessories, when so ordered.

Full description in Catalogue B.

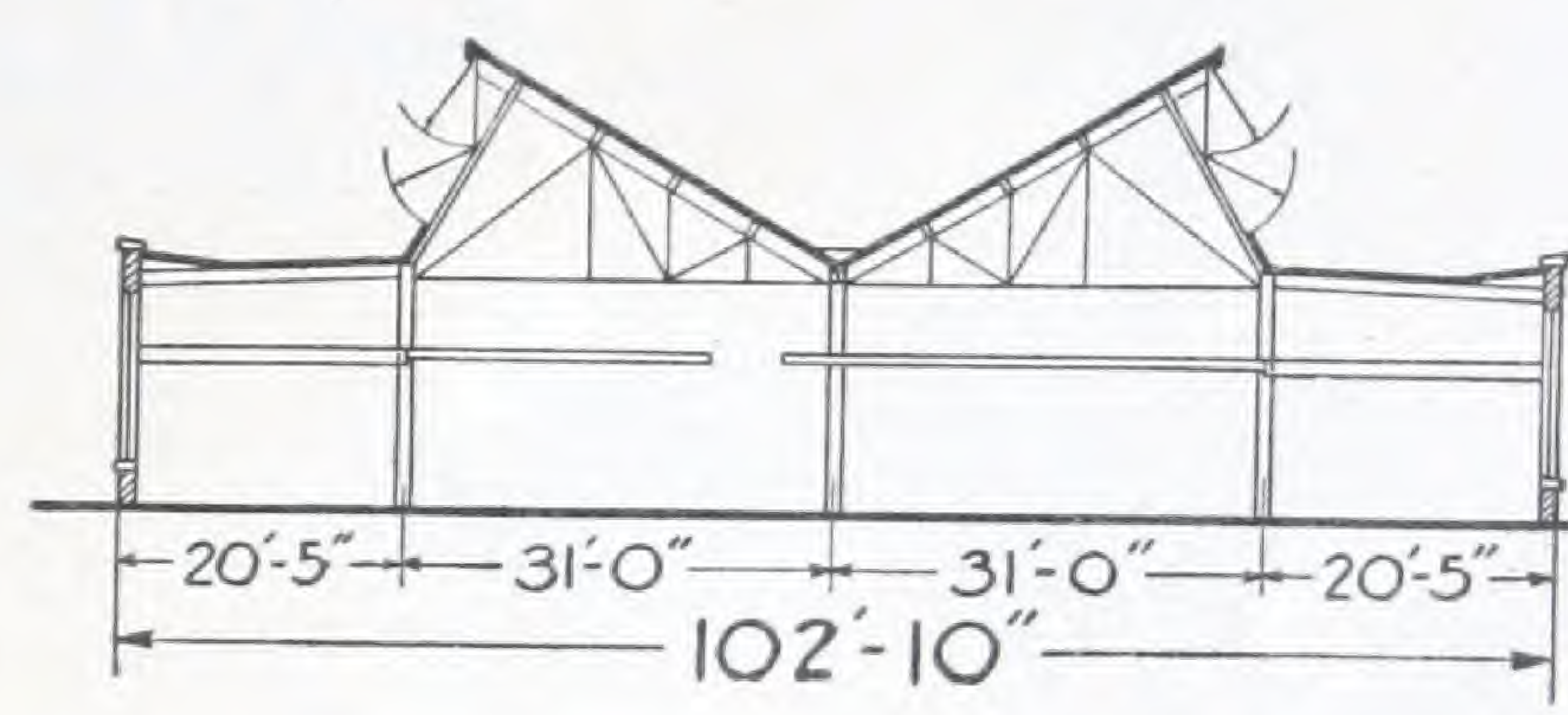
Bunting Brass & Bronze Co.
Foundry, Toledo, Ohio.
Messrs. Mills, Rhines, Bellman &
Nordhoff, Architects.
H. M. Lane Co.
Consulting Engineers.

This foundry is remarkable both for the high melting capacity secured (70,000 lbs. per day) with a limited floor area, and for its freedom from heat and smoke at all times. There are 32 furnaces arranged in two rows under the Pond Truss, and the upflow from these furnaces draws strong currents of fresh air from the side walls and from the ventilating tunnel under the aisle. At each furnace there is a grating in the aisle floor, and the furnace tenders working in the aisle are always comfortable.





To the left is a floor plan of the Bunting foundry drawn on a small scale. See photographs, pages 30 and 34.



Mr. William Earl Russ
Architect

Hercules Gas Engine Co.
Piston & Cylinder Foundry, Evansville, Ind.

Despite its small size this building preserves perfectly the proportions that have been found successful in larger Pond Truss designs. Core ovens are placed in one side bay, with doors under the Pond Truss outlets.

Mr. William Earl Russ
Architect

Hercules Gas Engine Co.
Main Foundry, Evansville, Ind.

Owing to the light character of the work, cranes are required only over the two center bays, hence the side roofs can be made very low. With small, rapidly-handled castings, the tonnage melted per square foot of floor is often much larger than in a foundry where heavy castings are made: hence ample ventilation is imperative. The large inflow afforded by the four lines of Pond Continuous Sash in each side wall, and the corresponding outlet area in the Pond Truss roof, will be noticed.

Lupton

INVESTMENT VALUE

POND CONTINUOUS SASH
POND OPERATING DEVICE
POND TRUSS ROOF DESIGN

Catalogue 10-PCS